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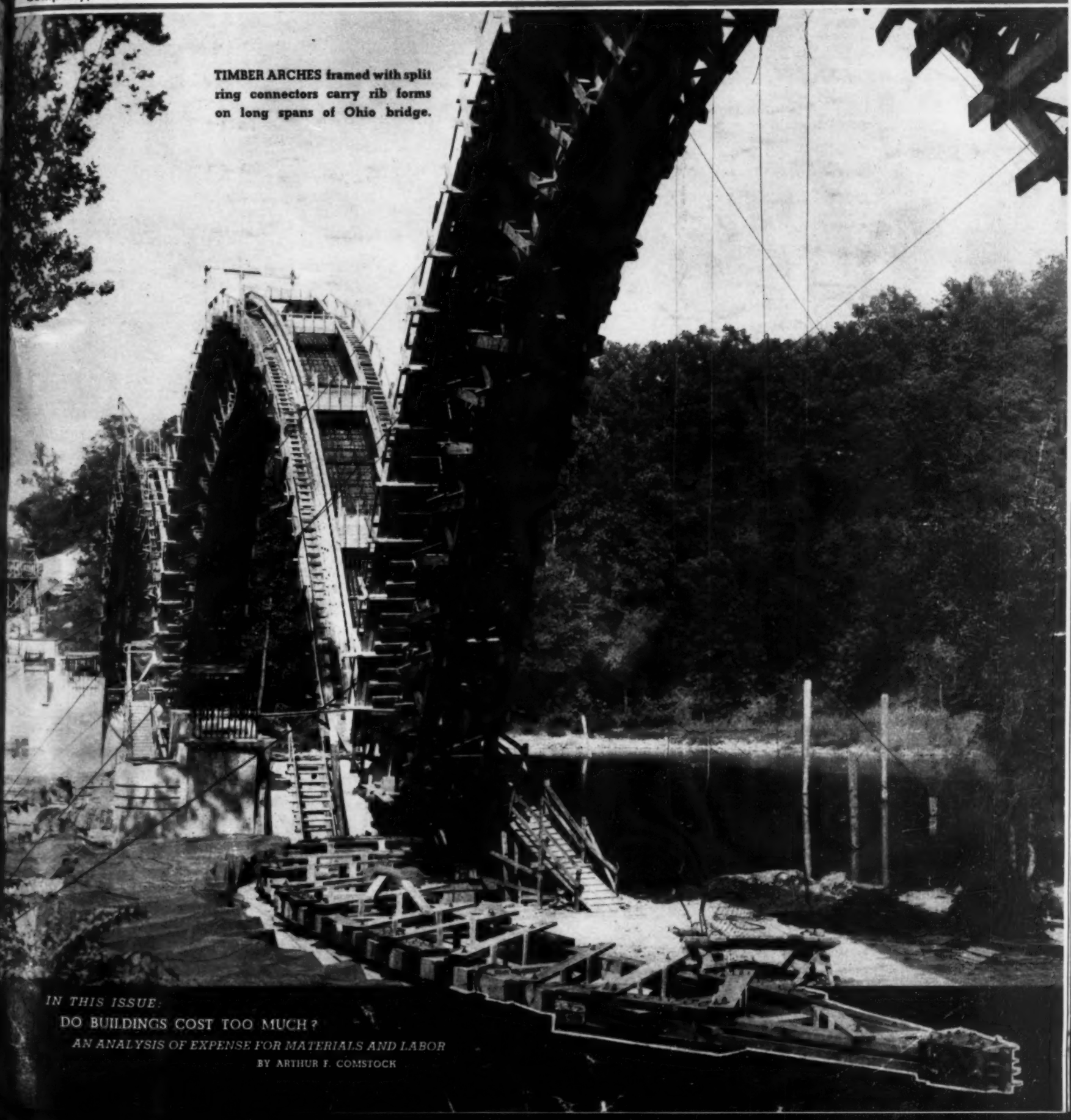

TIMBER ARCHES framed with split ring connectors carry rib forms on long spans of Ohio bridge.

IN THIS ISSUE:

DO BUILDINGS COST TOO MUCH?

AN ANALYSIS OF EXPENSE FOR MATERIALS AND LABOR

BY ARTHUR F. COMSTOCK

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Construction
Methods and Equipment

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WILLARD CHEVALIER, Vice-President

APRIL, 1938

CURRENT JOBS
. . . . and Who's Doing Them

BUILDINGS

Public—At Mont Alto, Pa., $2,622,200 contract for children's hospital was awarded to **John McShain, Inc.**, of Philadelphia. For remodeling post-office annex in New York City, **Millimet Construction Co.**, of Union City, N. J., received award amounting to $1,849,000. At Warren, Ohio, **Lundoff-Bicknell Co.** was successful bidder on a state hospital job amounting to $797,000. For a manual training high school in Brooklyn, N. Y., to cost $653,600, **Federal Construction Corp.**, of New York City, was the successful bidder. In New Orleans, La., **Burkes Bros.**, of New Orleans, bid in for $683,-700 contract for hospital nurses' home. A new public school in the Bronx, New York City, costing $659,000 is being started by **Psaty & Fuhrman**, of New York. In Danville, Pa., successful bidders on a hospital job were **Irwin & Leighton**, of Philadelphia, with a price of $637,000. **O'Driscoll & Grove**, of New York City, are engaged upon a $696,131 post office renovation job in New York. A prison dormitory at Jefferson City, Mo., is under construction by **E. C. Childers Construction Co.**, of Kansas City, for $552,000. **Southeastern Construction Co.**, of Charlotte, N. C., is building at Charleston, S. C., college buildings costing $499,-902. A $494,733 Veterans hospital job at Roanoke, Va., went to **A. Farnell Blair**, of Lake Charles, La. Contract for state hospital and power house at Scranton, Pa., was bid in by **Karno-Smith Construction Co.**, of Trenton, N. J. for $617,000.

Commercial—A number of large scale housing developments in the Borough of Queens, New York City, near the site of New York World's Fair, were announced last month. In Forest Hills, the projects included $16,375,000 by **Farmers Estates Corp.**, of Brooklyn; $2,000,000 **by H. D. Burchell**, of Brooklyn; and $1,640,000 by **Roxton Hills Corp.** In Flushing, New York, a $10,000,000 residential development by **N. K. Winston & Co.**, of New York. In Corona, N. Y., a $2,875,000 apartment project by **Queens-Horace Harding Corp.**, of New York. In Elmhurst, N. Y., a $2,400,000 apartment project by **Queens-Horace Harding Corp.**, of New York. Low bidders for water amphitheatre at World's Fair site on Flushing Meadow, New York, were, for substructure, **Young Fehihaber Pile Co.**, of New York City, at $308,470 and for superstructure, **Psaty-Fuhrman, Inc.**, of New York, at $1,-024,000. At 11-25 Madison Ave., New York City, **Starrett Bros. & Eken, Inc.**, of New York City, are beginning construction of a $10,000,000 office building for the Metropolitan Life Insurance Co. **Realty Associates, Inc.**, of Brooklyn, have undertaken a $1,200,000 apartment project at Maspeth, N. Y. In Chicago, a $1,000,000 store building for Sears Roebuck & Co., is under way by **Lundoff-Bicknell**, of Chicago. A $1,000,000 home development at Ridgewood, N. J., is being directed by **G. Peterson**, of Ridgewood. At Raleigh, N. C., **T. A. Loving Co.**, of **Goldsboro, N. C.**, received a $800,000 apartment house job. For Harvard University, at Cambridge, Mass., **Aberthaw Co.** of Boston, is building a $750,000 structure.

Industrial—At Youngstown, Ohio, under separate contracts, **Youngstown Sheet & Tube Co.** is constructing additions to plant. A concrete office building at Austin, Tex., was bid in for $550,000 by **Brown & Root, Inc.**, of Austin

SEWERS

Low bidder for sewage plant structures at Baltimore, Md., was **Virginia Engineering Co.**, of Newport News, Va., with price of $726,684. Bid of $584,849 for sewers in Long Island City, N. Y., was received from **Chas. Bennett Improvement Co.**, of Brooklyn. The city of Detroit, Mich., awarded a $260,000 contract to **A. W. Kutsche Co.**, of Detroit, for sewage tank. For $153,-267, **W. Loomis & Son**, of Logan, Ohio, are building a sewage treatment plant at Circleville, Ohio. **Strandberg & Spencer, Inc.**, of Chicago, are building a $144,900 sewage treatment plant at Ypsilanti, Mich.

DAMS

Low bidders for Possum Kingdom dam on Brazos River, Tex., were the **A. L. Johnson Construction Co.**, of Minneapolis, and **C. F. Lytle Co.**, of Sioux City, Ia., for $3,287,000. With price of $2,658,171. **Central Engineering Co.**, of Davenport, Ia., obtained contract for Mississippi River dam No. 24, at Clarksville, Mo. The U. S. Bureau of Reclamation awarded a $2,108,445 contract for Vallecito dam, in Colorado, to **Martin Wunderlich Co.**, of Jefferson City, Mo. In Nebraska, **J. A. Tertling & Sons**, of Boise, Idaho, bid in for $845,590 contract for supply canal for Central Nebraska Power and Irrigation District. Successful bidder for Deer Creek dam, on Provo River project in Utah, was **Rohl-Connolly Co.**, of Los Angeles, Calif., with price of $2,189,096. For completing main shafts at Fort Peck dam, in Montana, **Fegles Construction Co.**, of Minneapolis, obtained contract for $1,876,922.

BRIDGES

Bridge contract at Flushing, N. Y., went to **L. P. O'Connor**, of New York City, for $1,199,851. Contracts for Missouri River bridge, at Omaha, Neb., were awarded to **Minneapolis Bridge Co.**, of Minneapolis, for $411,402 and $844,950 respectively. **Puget Construction Co.**, of Seattle, Wash., is building a $748,337 bridge over the Snake River in Idaho. **Lane Construction Corp.**, of Meriden, Conn., has a $203,245 highway bridge contract at Ashland, N. H. At Elizabeth, N. J., **J. F. Chapman & Son**, of Philadelphia, are building a $220,900 bridge. Substructure contract for $1,500,000 Tennessee River bridge, at Florence, Ala., went to **Hardaway Contracting Co.**, of Columbus, Ga.

HIGHWAYS

Recent highway contract awards included the following—New York: Concrete paving in Nassau County, to **Garofano Construction Co.**, of Mount Vernon, $515,212. Maine: Bituminous surfacing in Hancock County, to **Sammons, Robertson & Henry**, of Huntington, West Va., $376,340. New Jersey: Hackensack Plank Road paving to **Clinton Asphalt Co.**, of Ridgefield, $384,566. Texas: Concrete paving in Colorado County to **H. B. Zachry**, of Laredo, $200,917. Oklahoma: Paving in Caddo County to **Ryan Construction Co.**, of Oklahoma City, $249,608. Alabama: 19 mi. of paving in Pickens County to **Hardaway Contracting Co.**, of Columbus, Ga., $244,348. Mississippi: 13 mi. of paving in Lamar County to **Barber Bros. Construction Co.**, of Baton Rouge, La. $279,993.

WATERWORKS

Pipe line for Seattle, Wash., to cost $611,579 is being built by **Puget Sound Machinery Depot**, of Seattle. In Brooklyn, N. Y., **A. W. Banko**, of Forest Hills, N. Y. has a $377,000 water main contract.

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How BELT CONVEYOR delivered concrete from mixer to invert and arch forms on aqueduct construction. — p. 33
How LABOR AND MATERIAL PRICES affect construction cost of 20-story office building. — p. 36
How TIMBER CONNECTORS were employed to form strong joints in trusses for arch bridge centering. — p. 40
How ARCH CENTERING for 175-ft. concrete bridge spans was erected by two methods. — p. 40
How OIL AGGREGATE SURFACING was plant-mixed to pave secondary roads at low cost. — p. 42
How ASPHALT PLANT was equipped to produce 60 tons of material per hour. — p. 43
How MECHANICAL SPREADER distributed plant-mix bituminous road surfacing. — p. 44
How ROTATING RIG placed concrete in circular sewage treatment tanks. — p. 45
How INVERT CONCRETE in circular tank was finished with lattice truss screed. — p. 45
How WELDED STEEL TANKS were built to house huge aquarium. — p. 46
How SMALL-BORE TUNNELS in rock required solution of difficult blasting problems. — p. 48
How DEMOUNTABLE MINE CARS handled tunnel muck in close quarters. — p. 52
How PNEUMATIC PLACER delivered concrete through 5-in. pipe for lining rock tunnel. — p. 53
How PUMP on subgrade transferred water from tank truck to storage tank on paving mixer. — p. 54
How JOINT FILLER for concrete pavement was poured from improved "scooter" pot. — p. 54
How SWINGING HOPPER for concrete was rigged on car hauled up inclined railway. — p. 54
How WOOD FORMS were handled to provide for pouring concrete in lifts at big dam. — p. 55
How DIAMOND DRILL HOLE was used for delivery of electric power to tunnel. — p. 55
How RIVER BANK REVETMENT was accomplished by reinforced asphalt mattress. — p. 58
How ADJUSTABLE CABLE SYSTEM moored barges for laying asphalt mattress on river banks. — p. 58
How "STITCHING" of wire mesh reinforcement was done with stapling machine. — p. 59
How STEEL H-PILES were driven to support foundation of industrial buildings. — p. 61

ROBERT K. TOMLIN, Editor — A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, Paul Wooton (Washington), Nelle Fitzgerald

When the Foreman IS *the Company*

WAY BACK YONDER in 1917 this writer, as a shorthorn reserve officer, was soaking up from a veteran regular some unwritten lore of the Army. Along with other helpful counsel, this statement somehow has stuck through the years.

> "The company commander has the best job in the army. Of all the officers he is closest to the men whose performance will make or break him; his ability is most directly reflected in the work of his unit. Regardless of his age, he is the "Old Man" to each of his men; each of them feels closer to him than to any other officer. That intimacy may breed affection or hate, respect or contempt. But it does not breed indifference. Toward his colonel the enlisted man may cherish a faint liking or disapproval, based on how much drill he must suffer or on some other matter that affects his convenience. The colonel is like the weather; fair or foul, he's out of reach and not much can be done about it. But the company commander — that's different. To the man in the ranks, his captain *is* the army; and the morale of an army reflects the caliber of its company officers. That's why I say that the company commander has the best job in the army."

In these days of trouble between employers and employees, this writer often has wondered whether all this is not just as true of industry as it is of the army. In our preoccupation with "labor relations" are we in danger of drowning the human values in a sea of abstract issues? In dealing with "labor relations" problems, we frequently forget that some of the problems themselves may result from our thinking of men and women as pawns in a game of "labor relations." Can it be that some of these "labor relations" problems are, in fact, problems in "employer relations"?

JUST AS Private (1st cl.) Jim Doakes may have a very detached attitude toward Col. J. Jerome Noakes and a very personal regard, either positive or negative, for his "Old Man", Capt. James J. Folks, so Private Doakes in the ranks of industry may feel toward his superior officers. President Noakes may be as social minded, human and generally decent as anyone could be; but if foreman Folks happens to be an s.o.b. net, the morale of that outfit is likely to suffer.

Now and then someone reminds us that one cause of increasing friction between employers and employees is the loss of personal touch between the human beings that happen to occupy those roles. In the "old days", we are told, it was different. There is much truth in that. But obviously the brass-hats of modern industry cannot possibly be so close to all their people. An occasional trip through the works to call a few by name or slap them on the back won't do it. Such antics too often are despised by employees, the more when they obviously are a pose. Deplore it as we will, we must recognize that modern conditions unfortunately preclude such relationships. In our industrial army our colonels and generals usually are too far removed from the privates.

BUT THAT VERY FACT demands more care in the choice and training of company officers and non-coms. No bloodless policies of "labor relations" can supplant their front-line human leadership. The tactless, selfish, arrogant attitude of a superintendent may wreck the most thoughtfully planned edifice of "labor relations." A group of workmen, smarting under a real or fancied grievance in the shop, and with but scant feeling toward the men at the top, may sabotage an organization just to "shoot their foreman in the back." And all this to the bewilderment of the best intentioned management, righteously aware of its "labor relations."

Too often the general welfare of all, both workers and employers, is at the mercy of a superintendent, straw-boss or foreman, selected with little thought of this vital function of maintaining morale. To many a man in the shop or on the job, his foreman *is* the company. And his attitude toward the *company* is just what that *foreman* makes it.

Willard Chevalier

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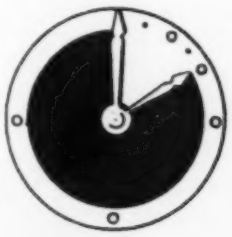

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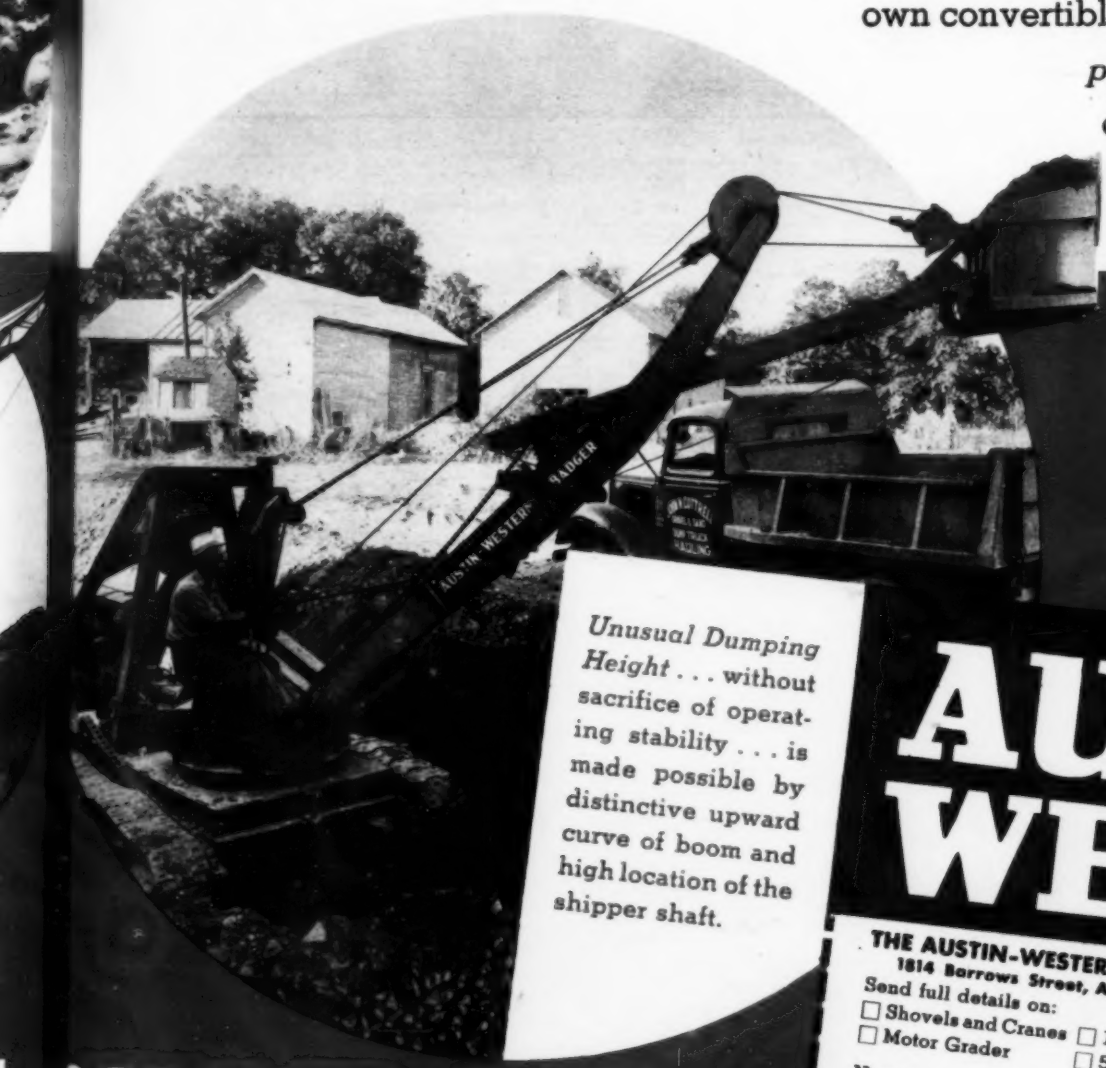

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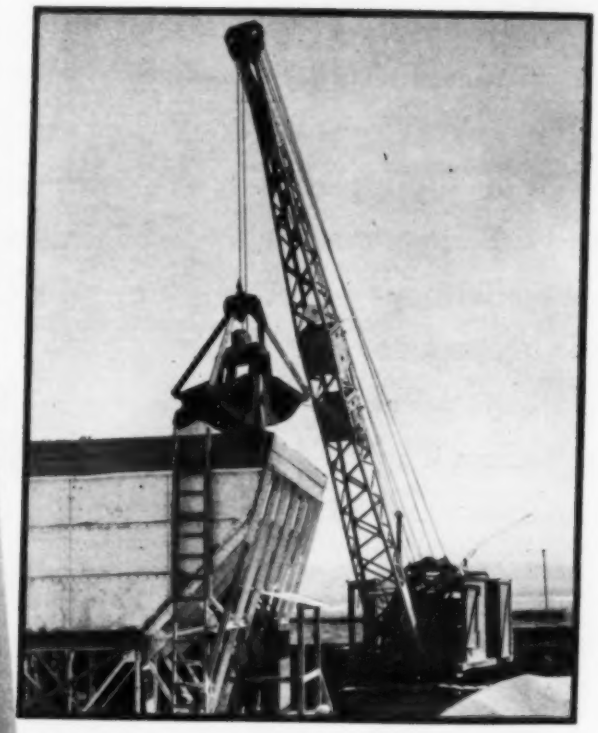

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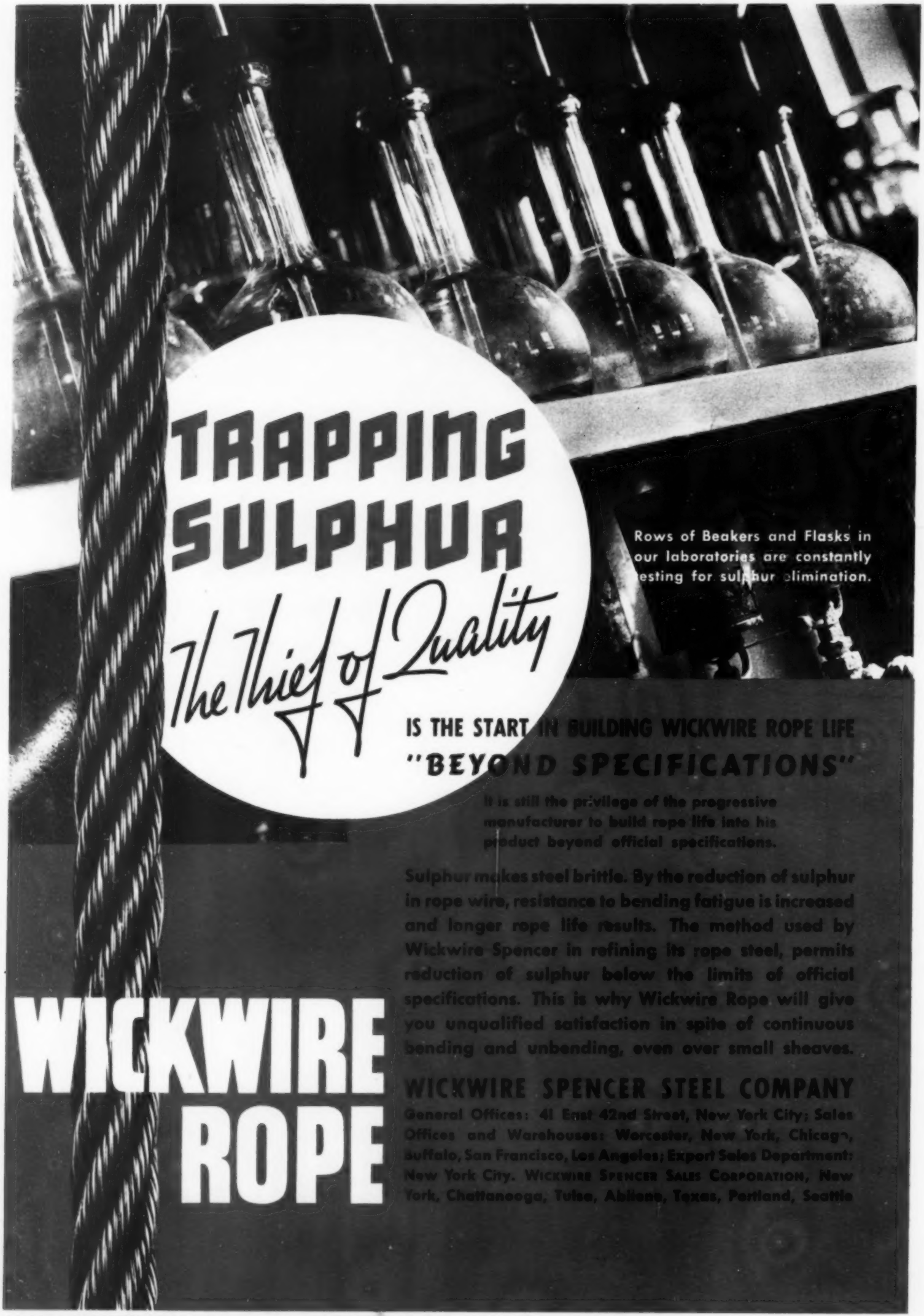
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B *A "Caterpillar" Diesel D7 Tractor and cable-controlled LeTourneau ripper loosening hard-pan (close-packed rock, clay, slate, etc.) for the carryall scrapers.*

C *A "Caterpillar" Diesel D8 Tractor with a loaded LeTourneau carryall scraper approaching the dump. (Illustration shows cut and fill work nearing completion.)*

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AS A contractor or highway engineer, you know how unexpected rock or other snags can play havoc with costs, throw work programs out of gear, and send penalty shivers up and down your spine. Though such and other unforeseen difficulties have been encountered on this safety-intersection project — wisely planned by the State of Iowa — they are not deterring Contractor Sears. . . . For *all the earth-moving equipment on the job is "Caterpillar" powered.*

Slate, rock and hard clay raise their challenge, but a powerful "Caterpillar" Diesel D7 Tractor, pulling a cable-controlled ripper, quickly loosens the material and enables the four D8 Tractors and LeTourneau carryall scrapers to pick up the tough dirt and hurry it away.

So, too, with sure, steady, economical "Caterpillar" Diesel power do bulldozers, graders — and additional scrapers — perform their respective tasks with so little delay or time-out for repairs that the whole huge job of moving 700,000 yards is holding right to schedule . . . "without a headache."

Mr. Sears says further: "In equipping our outfit, we kept in mind the fact that we must have large yardage-producing units with versatility and adaptability. Our experience has proved our wisdom in the choice of 'Caterpillar' Diesel Tractors and scrapers.

"On this project with this equipment, we are handling profitably material which otherwise would necessitate our using a variety of other, less economical methods. After thousands of hours of heavy-load operations, 'Caterpillar' Diesels have thoroughly proved their dependability and economy. We are more than pleased with the service this equipment is giving us."

DIESEL ENGINES • TRACK-TYPE TRACTORS • ROAD MACHINERY

RPM

REG. U.S. PAT. OFF.

DIESEL ENGINE LUBRICATING OIL

Approved by
CATERPILLAR TRACTOR CO.

"RPM" Diesel Engine Lubricating Oil is distributed by the following companies under the brand names indicated:

IN THE UNITED STATES

"RPM" Diesel Engine Lubricating Oil:
THE CALIFORNIA COMPANY (Montana only)
THE CARTER OIL COMPANY, Tulsa, Oklahoma
HUMBLE OIL & REFINING COMPANY
STANDARD OIL COMPANY (Indiana)
STANDARD OIL COMPANY (Incorporated in Kentucky)
STANDARD OIL COMPANY (Nebraska)
STANDARD OIL COMPANY OF CALIFORNIA
STANDARD OIL COMPANY OF TEXAS
UTAH OIL REFINING COMPANY

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COLONIAL BEACON OIL COMPANY, INC.
STANDARD OIL COMPANY OF LOUISIANA
STANDARD OIL COMPANY OF NEW JERSEY
STANDARD OIL COMPANY OF PENNSYLVANIA

Signal "RPM" Diesel Engine Lubricating Oil:
SIGNAL OIL COMPANY

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THE STANDARD OIL COMPANY (Ohio)

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"RPM" Diesel Engine Lubricating Oil is also available through distributors in more than 100 other countries.

RPM
REG. U.S. PAT. OFF.
DIESEL ENGINE
LUBRICATING OIL
LOOK FOR THIS NAME
The "RPM" trade-mark appears on every container of genuine "RPM" Diesel Engine Lubricating Oil. It is your assurance of superior lubrication.

More "RPM" Diesel Engine Lubricating Oil is being sold and used in "Caterpillar" Diesel Engines than all other Diesel oils combined

STANDARD OIL COMPANY OF CALIFORNIA

Upper photo: "Carrimor," rated at 6 yards, carrying a 7 yd. load with ease.
Lower photo: "Carrimor" digs a full load from slippery, frozen ground.

LAPLANT-CHOATE "CARRIMOR" *Hydraulic Scraper*

Does Earth Moving Jobs Other Scrapers Won't Do!

When you use a scraper that carries more yardage than its rated capacity . . . a scraper that carries a peak load every trip even under the most adverse weather and ground conditions, your profits increase. The new LaPlant-Choate "Carrimor" scraper, with safe, dependable hydraulic control, gives you every time-saving, money-saving advantage a modern scraper should have. The scientifically designed bell shaped bowl and narrower cutting edge correctly guide the incoming earth and reduce loading resistance so that you get a peak load every time with less power. Conventional straight side bowls won't do this because of loading resistance.

LaPlant-Choate's "Carrimor" is easy to maneuver, even in close quarters. Rear dumping assures clean, fast work on any job. Positive down pressure assured by effortless, one-man hydraulic control, means powerful, unfaltering digging. You can operate a "Carrimor" in combination with your Bulldozer because both use the same hydraulic power and controls. Available in 3 sizes for use exclusively with "Caterpillar" D-4; D-6; and D-7 Tractors. Get full details from your nearest "Caterpillar" dealer. Write us today for free circular.

LAPLANT-CHOATE MEANS Lower Costs

ROADBUILDERS
SNOW PLOWS
TAMPING ROLLERS

LA PLANT-CHOATE MANUFACTURING CO. Inc.

BULLDOZERS
BRUSH CUTTERS
RUBBER WHEEL WAGONS

CEDAR RAPIDS, IOWA.

SEARS GIVES IOWA A BREAK!

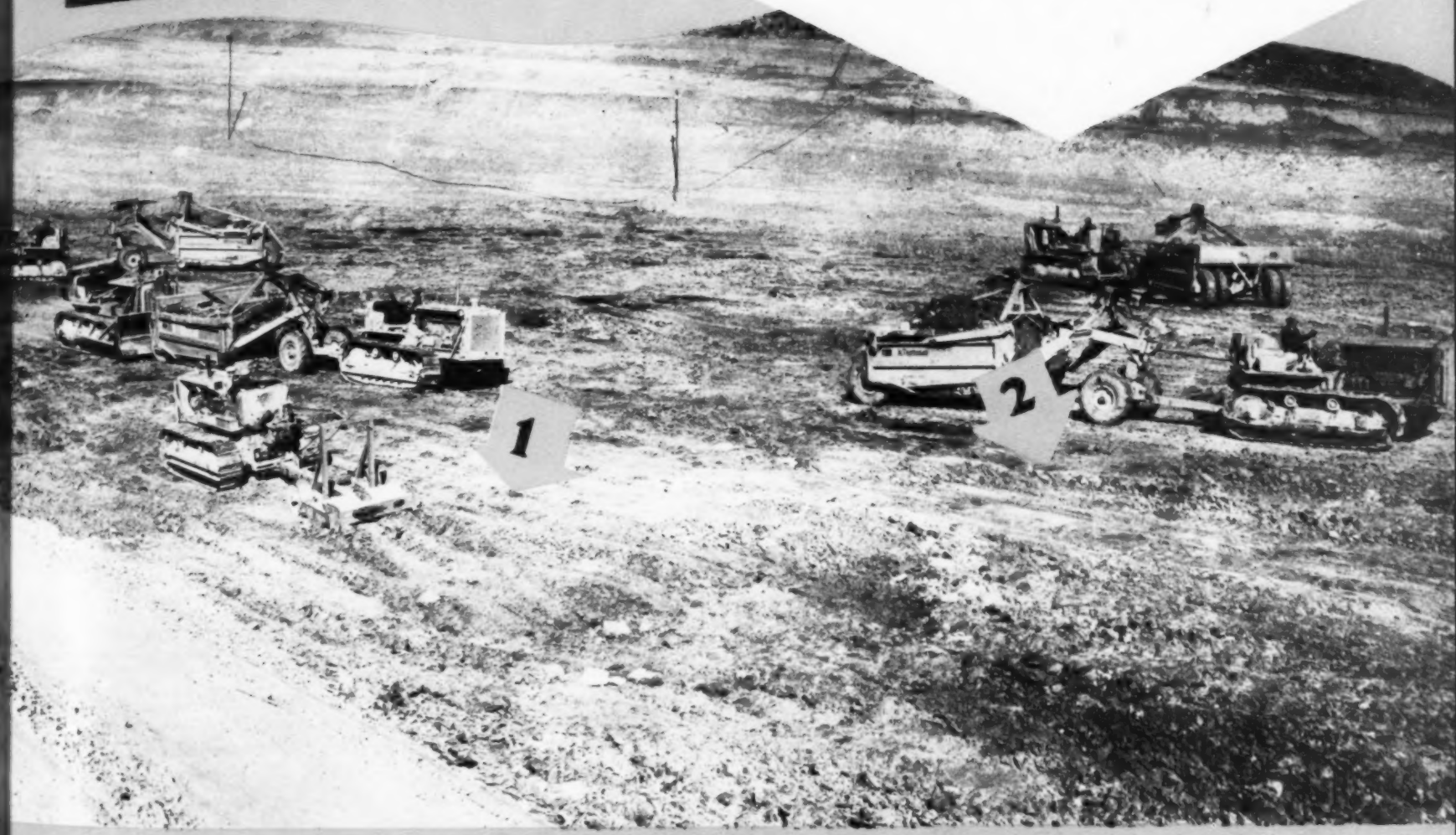
Today's demands for safer highways for a safety-conscious public has faced many a highway department with costly problems . . . no exception is Iowa. But in this case, a contractor's ingenuity solved these problems . . . permitting a lower bid price for carrying out a construction program . . . this, passing the savings in cost on to the state.

Sears Construction Company, of Clear Lake, Iowa, is building the Adel railroad separation and Cloverleaf highway crossing with LeTourneau equipment. Among other normally expensive excavation problems encountered to date was 5,000 cu. yds. of ledge rock . . . a mud cut of 20,000 cu. yds. . . . 20,000 cu. yds. of channel change excavation. Each was handled in a routine sort of way . . . at typical tractor-Scraper speed . . . at costs comparable only to the LeTourneau methods.

Further, most of the "ordinary" excavation is hard packed clay strewn with boulders of varying sizes. Yet, the job has been LeTourneau all the way; the only exception: 10,000 cu. yds. handled with an elevating grader. Best evidence of the success enjoyed by Sears is a yardage figure of 350,000 cu. yds. excavated, hauled and placed in a total of 3,754-Scraper hours.

A LeTourneau Heavy Duty Rooter (1) breaks up the hardpan . . . loosens and removes the boulders. Four LeTourneau 12-Yard Carryalls pick up the loosened material in loads (2) that "boil" over in short distances . . . haul over distances varying from several hundred to more than a thousand feet. The even spreading and compacting action of the Carryalls on the fill prepare the final grade.

Thus, again LeTourneau equipment offers the lowest cost solution to a modern construction demand. Ask your "Caterpillar" dealer for a demonstration of LeTourneau equipment right on your job.

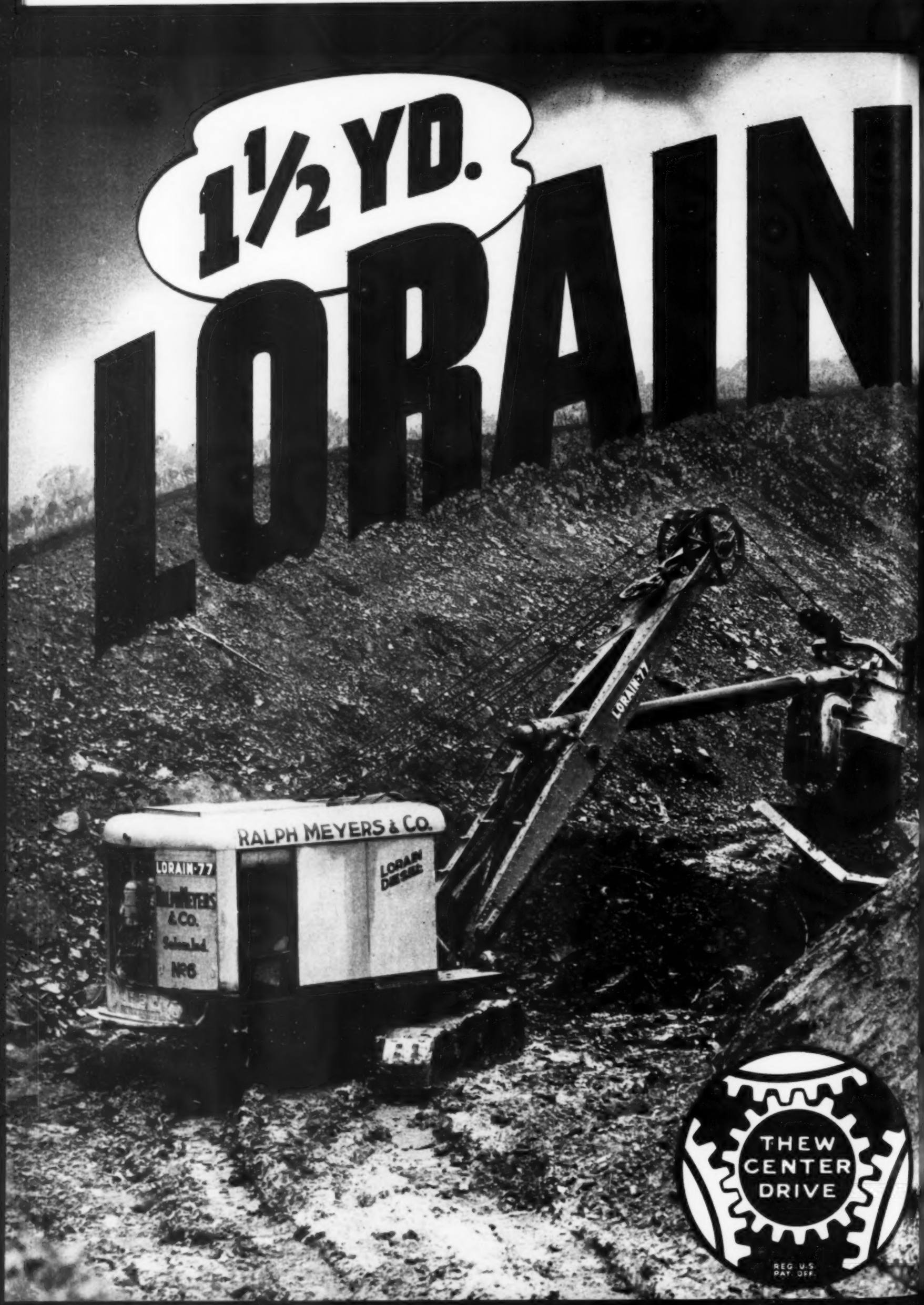


LETOURNEAU

R. G. LeTOURNEAU, INC., • Peoria, Illinois • Stockton, California • Cable Address: "Bobletorno"

Manufacturers of: Angledozers*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters*, Treedozers.

*Name Registered U. S. Patent Office.


1½ YD.
LORAIN
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DRIVE
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The Shovel that Dominates in Any Digging

The 1½-yd. Lorain-77 has been exposed to every kind of digging this continent has to offer. In each case, this shovel has proved its superiority by the one method which really counts with experienced contractors, that is, moving more material, faster, at lower cost.

If you want a shovel with the ruggedness, power, and speed that only Center Drive can give you, write today for catalog and performance data on the 1½-yd. Lorain-77.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

Photo by Hedrich-Blessing Studio, Chicago

BEAUTY AND ECONOMY FOR OWNERS PROFITS FOR CONTRACTORS in Architectural Concrete jobs like this

One of the 1938 crop of new Architectural Concrete buildings is Warner Brothers' Rhodes Theater in Chicago — a fine example of quality concrete well formed. C. W. and George L. Rapp, Inc., were the architects. J. W. Snyder Company, contractor.

Owners of big buildings (theaters, factories, offices and public structures) and the owners of one and two-story commercial buildings, are equally enthusiastic about Architectural Concrete. They like its good looks at low cost, its firesafety and long life with low maintenance.

When you build with Architectural Concrete, wall texture and ornament are *created in the forms.* If you are interested in bidding on the important Architectural Concrete jobs coming up, you will want the free manual, *"Forms for Architectural Concrete"* and the handy *"Concrete Guide, with Tables of Quantities of Materials."* Write for your copies today.

PORTLAND CEMENT ASSOCIATION
Dept. A4-16, 33 W. Grand Ave., Chicago, Ill.
A National Organization to Improve and Extend the Uses of Concrete

Architectural Concrete . . . WALLS AND ORNAMENT CAST INTEGRAL WITH FRAME AND FLOORS

NOVO NEWS REEL

Water — you have to have it for gravel washing. Here the Novo 4" Self-Primer is furnishing water for the washing plant in the background. Look at the head against which that pump is working — from suction to discharge at the top of the plant.
Consolidated Construction Co.
Birdville, Texas

(Left) Lake formed on the operations of the Shovel Placer Mining Co. of northern California. Severe storms caused their excavation to become completely filled. (In the circle) are shown two Novo Pumps that were used to de-water this large area. These Pumps saved a great loss by preventing caving of the tailing piles around the hole.
(Below) A close up of the 8" and 6" Novo Self-Primers shown in the circle at the left. — The Pumps that saved the gold. — They will save money on any job.

(Below Right) The Licking Gravel Co. of Newark, Ohio, are "licking" their gravel handling problems with this Novo Dragline Hoist powered with a 40 H.P. electric motor. They are taking out 400 Cu. Yd. per day. The news behind this news is — Hoist is multiple steel roller chain drive. The double cone friction blocks are of asbestos composition, giving a double friction area of highly efficient, long-lived material.
Send for complete information on Novo Self-Priming, Centrifugal, Diaphragm, Pressure, and Road Pumps. Also any type and size of Builders and Dragline Hoists.

NOVO ENGINE CO.

214 Porter St. Lansing, Mich.

THE *Small* SHOVEL WITH A

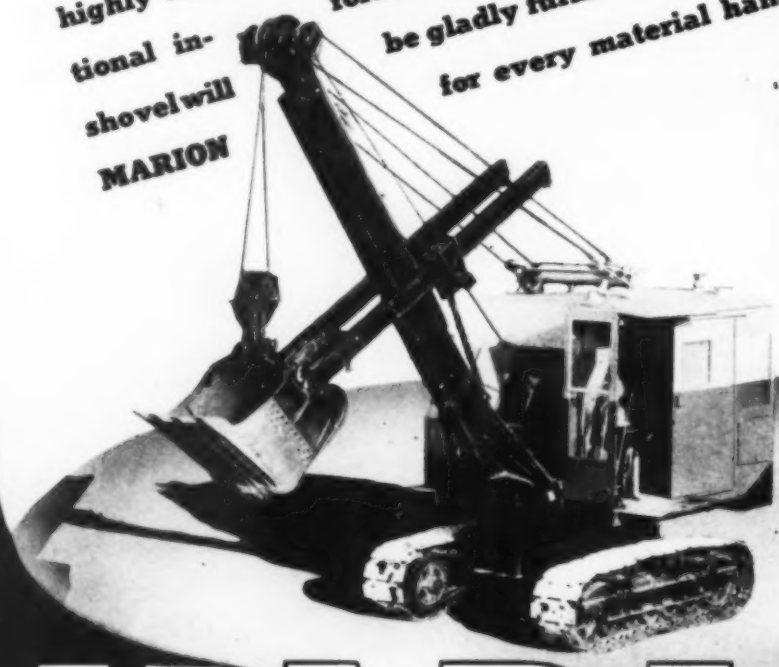
BIG PERFORMANCE

RECORD IN THE FIELD • • •

EVERYONE AGREES IT'S THE NEW

MARION 3/4 CU. YD. MACHINE

Designed and built with the same care and skill as its "big brothers" in the Marion line, this Type 331-3/4 cubic yard excavator is rolling up imposing performance records in sand and gravel pits, in highway construction and maintenance, in building excavation work and on other jobs where use of a compact, highly mobile and easily operated machine is desirable. Additional information concerning this big value in a small shovel will be gladly furnished on request. ● There is a MARION for every material handling job. » »



"We are certainly well pleased with the performance of our Marion 331 dragline. On its first job it averaged 1,000 yards per ten-hour day for 130 days in building a new highway," says W. J. Bryant, Superintendent, I. Bryant Company, R[illegible]ville, Ga.

The MARION

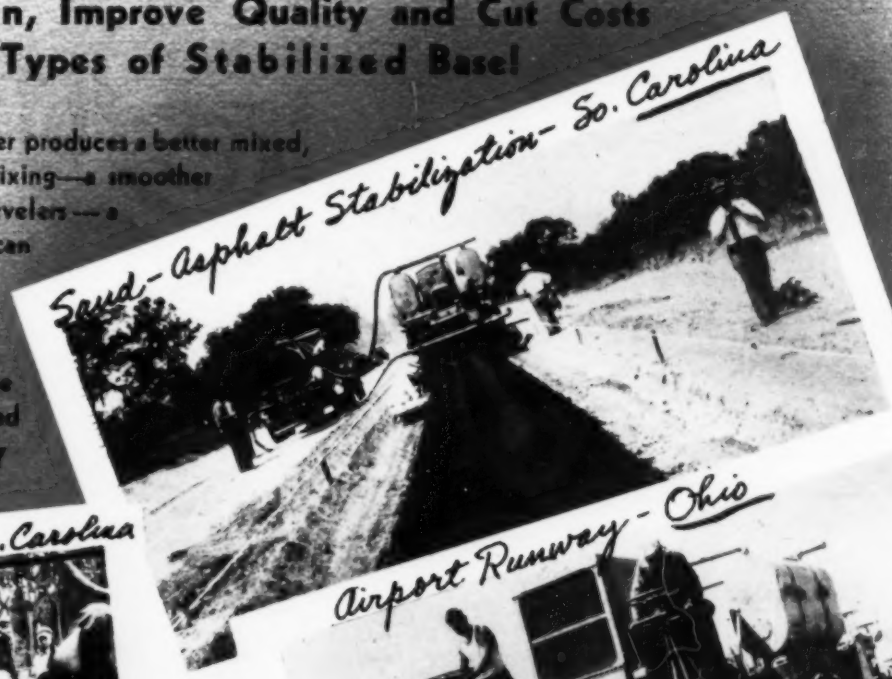
STEAM SHOVEL COMPANY • MARION, OHIO

PROVEN by the JOBS IT'S DONE

From Minnesota to Mexico, JAEGER Mix-in-Place ROAD BUILDER Has Demonstrated Its Ability to Increase Production, Improve Quality and Cut Costs on Retread and All Types of Stabilized Base!

One pass of this Self-Propelled Road Builder produces a better mixed, longer lasting road, due to twin-pugmill mixing—a smoother riding road, due to 21 ft. straight edge levelers—a lower cost road because one machine can mix and finish IN ONE PASS. Also built in popular priced, tractor drawn model, for light retread and stabilization. Send for Supplement MP-38, giving complete data and performance on jobs here pictured

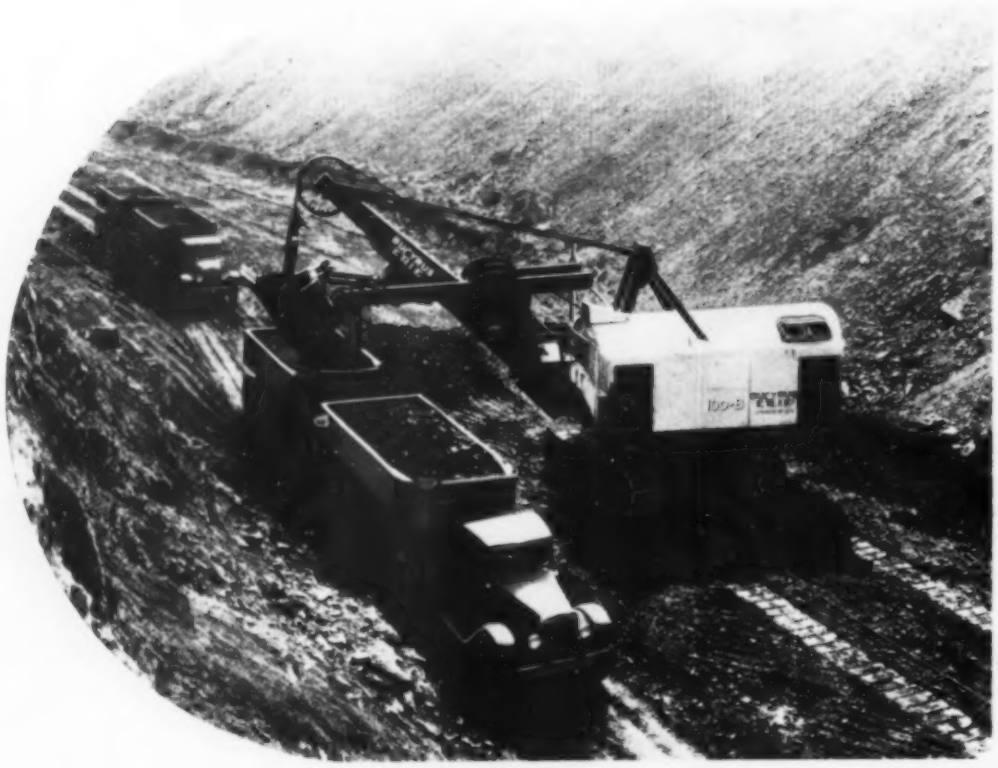
THE JAEGER MACHINE COMPANY
800 Dublin Avenue, Columbus, Ohio



JAEGER Mix-in-Place ROAD BUILDER

ALLOY NICKEL STEELS

Boost the PAYLOAD . . . ⇧ ⇩ *and* CUT HAULAGE COSTS



40 TONS PER TRIP

Typical of the tremendous capacities that are being developed through the use of the Nickel alloy steels, are these trailer units which handle 40 tons of coal per trip in an Illinois strip mine. By employing strong, tough Nickel alloy steels, the manufacturer, Austin-Western Road Machinery Co. of Aurora, Ill., was able to develop giant trailers which have substantially reduced haulage costs. Weight of parts was materially reduced, without decreasing safety factor or dependability. Nickel alloy steels were used for the rear axles, spring shackle bolts, spring shackle shaft, spring clips, wheel studs, brake drum bolts, air cylinder valve stem, cross head and pivots.

WEIGHT REDUCED 25%–30%

Another striking example of high pay load capacities which the Nickel alloy steels make possible is this semi-trailer which carries a 20-ton load concentrated over a length of only 8 feet. The high strength-weight ratio of the Nickel alloy steels effected a saving of 25-30% in the weight of the frame as well as substantial weight savings in other highly stressed applications. Producer of this unit is Utility Trailer Manufacturing Co. of Los Angeles, using Nickel alloy steels obtained from Bethlehem Steel Co.

We invite consultation on the use of the Nickel alloy steels in your equipment.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

NORTHWEST

CRAWLER EQUIPMENT

IS BUILT IN A RANGE OF

18 SIZES

3/8 CU. YD. CAPACITY AND LARGER

NORTHWEST ENGINEERING COMPANY

1728 Steger Bldg. • 28 E. Jackson Blvd. • Chicago, Illinois

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS • SKIMMERS

gasoline • oil • diesel • electric

An Electric-Starting Cletrac helping to build the approach to the Lincoln Tunnel between New York and New Jersey.

with CLETRAC Diesels that *start at a touch of a button*

Every hour is productive with Cletrac Diesels or the larger Cletrac gasoline models on the job.

A touch of the electric starter button in the morning and they're on their way. Should they stall, and what tractor won't when you're forcing it to the limit, a touch of the button starts it again.

No delays. No hand cranking. No jumping up and down from the tractor. The result: the extra yardage that keeps difficult jobs up to schedule in spite of weather delays . . . that wins bonuses for "ahead-of-schedule" performance.

Experienced operators estimate that the increased yardage with electric starting Cletracs is as much as two days in thirty. In short . . . you get thirty-two days output for thirty days outlay.

Cletracs give extra yardage in other ways, too. With Controlled Differential Steering, an exclusive Cletrac feature, Cletracs handle larger loads on the turns . . . pull with both tracks when turning . . . take less time to go from the borrow pit to the dump.

Balanced design eliminates unnecessary dead weight . . . increases productive loads. Sound construction and simplicity of maintenance decreases down time.

There's a Cletrac to fit your operations . . . six different sizes from 22 to 95 horsepower, powered with either gasoline or Diesel engines. Get the whole story of Cletrac's "Built-to-Endure" construction. Put Cletracs on your jobs and watch yardage figures climb.

The Cleveland Tractor Co.
CLEVELAND, OHIO

Cletrac Crawler Tractors
Built To Endure
REG U.S. PAT. OFF.

CLETRAC CRAWLER TRACTORS

Quality Standards

Developed Here . . . help contractors cut operating costs . . . boost profits

Millions of dollars have been invested in new machinery by American industry in the past few years! Highly specialized new machines work with remarkable speed and accuracy . . . a tribute to the ingenuity of their designers—but a challenge to the manufacturer of lubricants.

For these modern machines demand better lubrication. Highly-finished gears and close-fitting bearings must operate day in and day out without appreciable wear. A "good oil" of yesterday may not meet today's needs. Quality standards for oils and greases must constantly rise.

Each day in the Gulf research laboratories a versatile group of highly-skilled technical men works to perfect better lubricants—to raise the quality standards for oils and greases. Their unceasing efforts bring real benefits to users of Gulf quality lubricants—in lessened wear, repair and maintenance expense for the machinery in their care. Let a Gulf engineer suggest ways of effecting economies in the operation of *your* equipment through the proper use of Gulf's higher quality oils and greases.

GULF INDUSTRIAL LUBRICATION

A COMPLETE LINE OF 553 QUALITY LUBRICANTS FOR INDUSTRY

Another "Atlas First"

ATLAS
announces
MANASITE BLASTING CAPS

Atlas Manasite Blasting Caps are the result of a new and exclusive combination of ingredients which materially increases the safety factor in the use of Explosives.

Atlas Manasite Blasting Caps contain an initiating material chemically known as Hexanitromannite which is less sensitive to impact and friction than the detonating compounds commonly used, thereby substantially increasing the margin of safety in the event of accidental mishandling.

This exclusive patented advance in making Atlas Manasite Detonating Caps is the result of several years' research by the Atlas Laboratories.

Full detonating Power is maintained with the important increase in safety.

Extensive field test in actual use has proven the excellent performance of the new Atlas Manasite detonators.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

Allentown, Pa.	Houghton, Mich.	Memphis, Tenn.	Pittsburg, Kansas	Seattle, Wash.
Boston, Mass.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Butte, Mont.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Chicago, Ill.	Knoxville, Tenn.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.

ATLAS
EXPLOSIVES

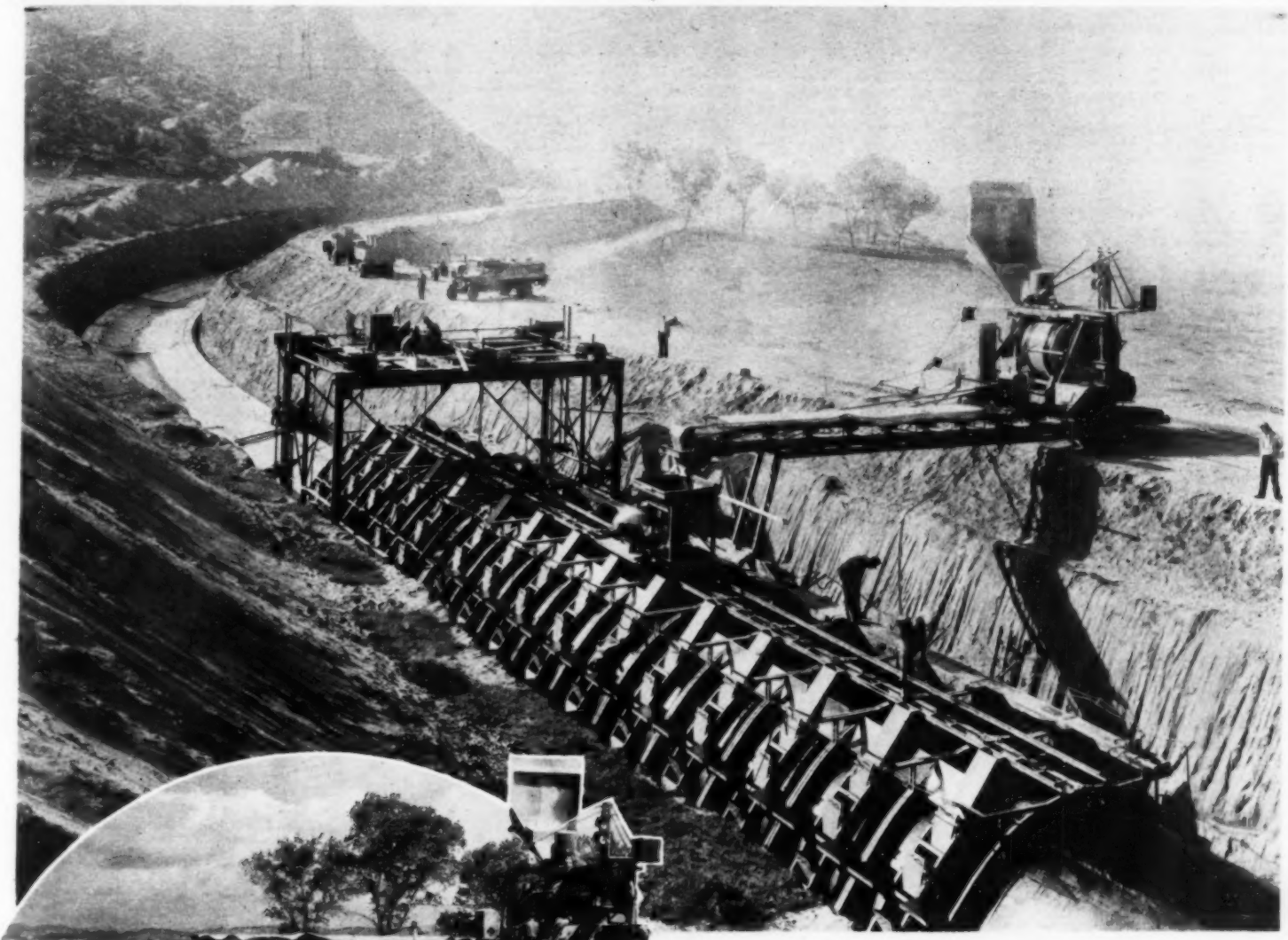
CHEMICALS ATLAS EXPLOSIVES

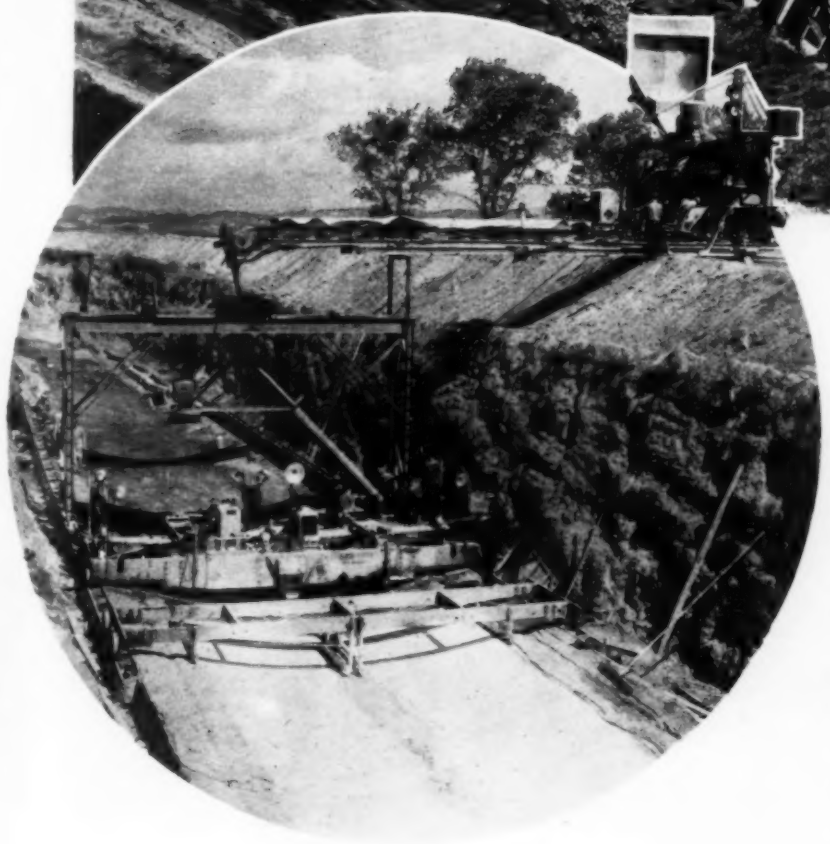
Construction Methods and Equipment

Established 1919 McGraw-Hill Publishing Company, Inc.

ROBERT K. TOMLIN, Editor

Volume 20 **April, 1938** Number 4





Mobile Plant

Places Conduit Concrete

INVERT AND ARCH CONCRETE of cut-and-cover conduit on the Griffith Co.'s contract for the Colorado River aqueduct passed from a paving mixer on the bank by means of belt conveyor to mobile hoppers traveling on steel forms. In the case of the invert, the hopper was mounted on a rolling gantry which traveled on steel rails supported by the edge forms. A counter-weighted radial spout distributed the concrete from the hopper to the invert. Rolling on the same steel rails, behind the distributing unit, was a finishing machine to strike off the invert. When building arch, a hopper car traveled on top of steel arch forms and discharged concrete through special spouts in the sides of the forms, which were equipped with numerous doors to facilitate placing and inspecting the poured mix.

Page 33

WORLD'S "DEEPEST" DAM was 85 per cent completed last month. Built across Colorado River to divert water into 242-mi. main line of Metropolitan Water District's aqueduct in Southern California, concrete arch structure extending to height of 320 ft., at roadway, extends to depth of 235 ft. below river bed. Under subcontract with Six Companies Inc., the J. F. Shea Co. is building dam for U.S. Bureau of Reclamation.

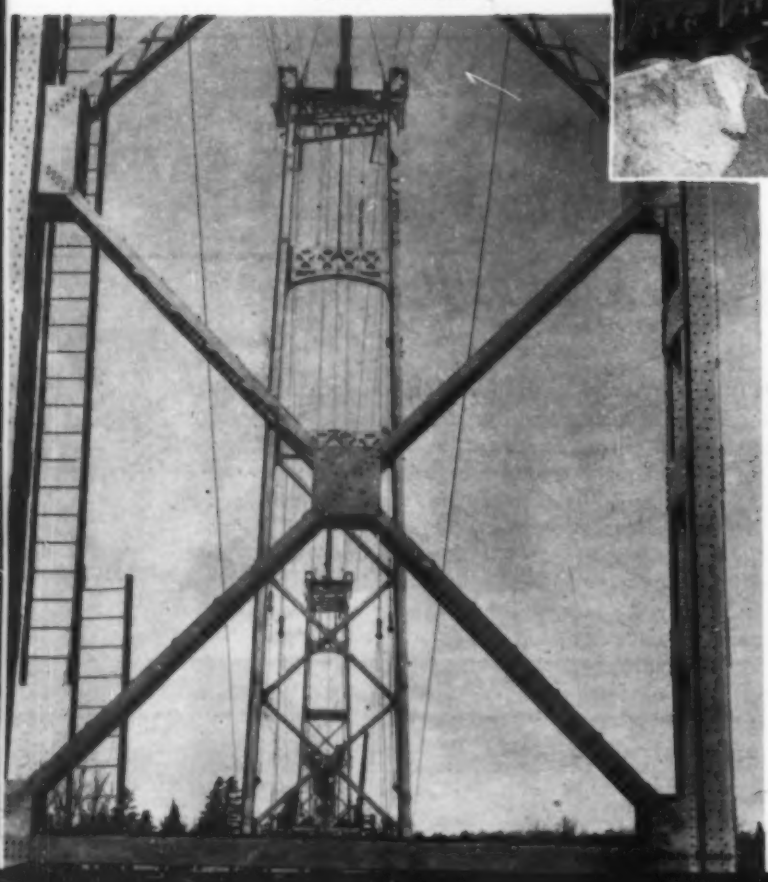
This Month's

"NEWS REEL"

CALIFORNIA FLOOD (above) last month washes out main line bridge of Southern Pacific Ry. across Los Angeles River. FLOOD DEBRIS **(right)**, 6 ft. in depth, is removed from tracks of Santa Fe Railroad by Griffith Co.'s Lorain 27 shovel.

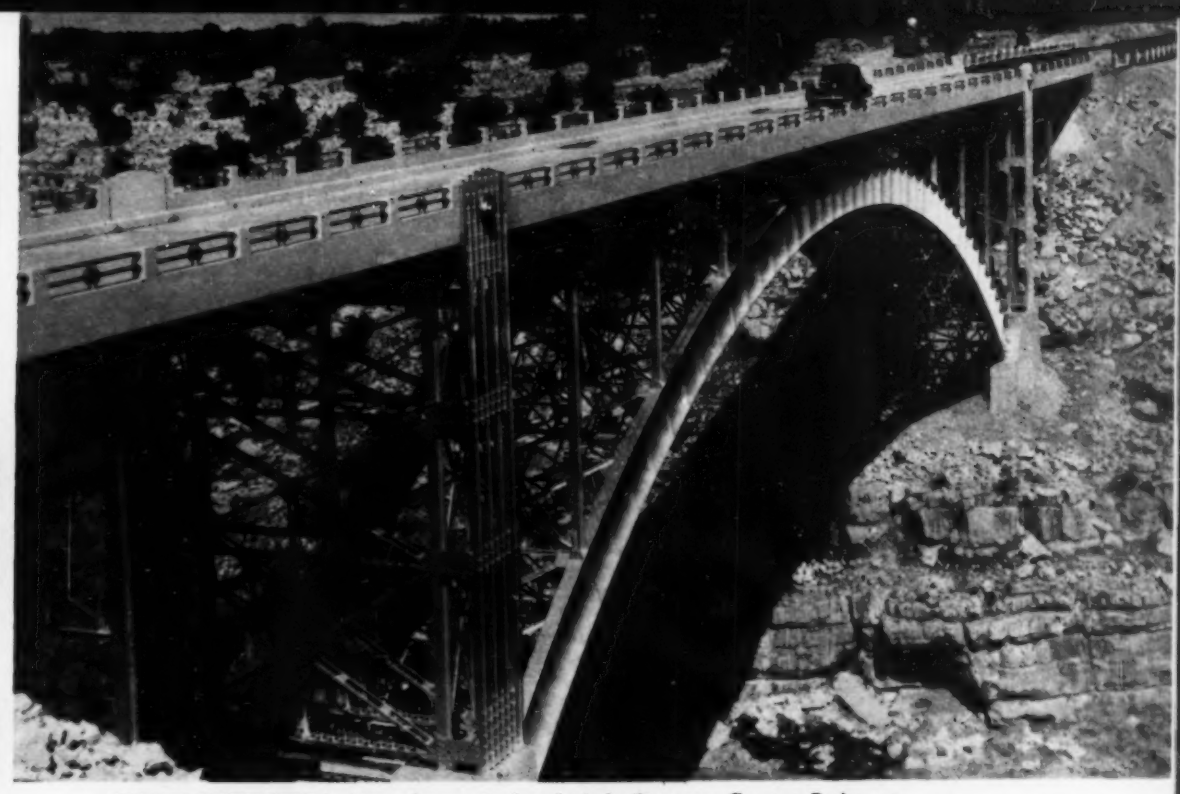
HOUSING EXECUTIVES CONFER. ALFRED RHEINSTEIN, (left) New York City's new Commissioner of Housing and Building and formerly head of Rheinstein Construction Co., views proposed housing site in Borough of Queens with NATHAN STRAUS, administrator, U. S. Housing Authority.

Wide World Photo



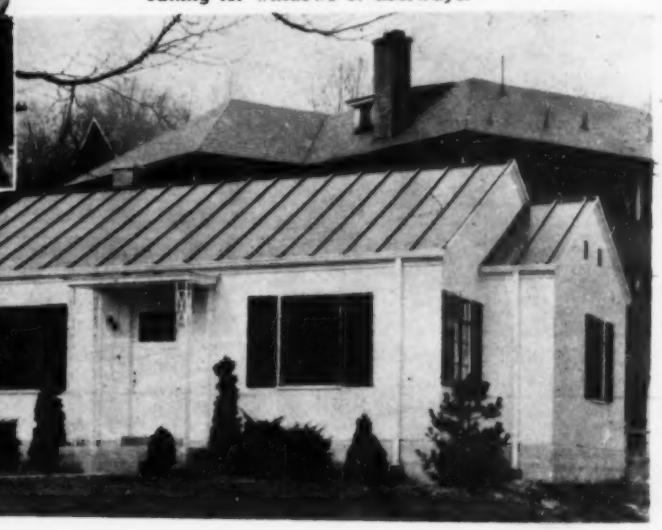
THOUSAND ISLANDS BRIDGE PROJECT(left) comprising series of bridges and connecting highways 9 mi. in length in vicinity of Watertown, N. Y., will carry traffic across St. Lawrence River between United States and Canada. Across American channel suspension bridge, with main span of 800 ft., designed by Robinson & Steinman, of New York, will be 4,500 ft. long. Canadian bridge, designed by Monsarrat & Pratley, will be 3,300 ft. long.

TVA'S CHAIRMAN. Dr. Arthur E. Morgan, noted builder of dams in Tennessee and Ohio River valleys, was removed by the President last month when he declined to testify at White House inquiry. Dr. Morgan stated his willingness to present all his facts before a Congressional investigating committee.



"SILVER RAINBOW." in form of new steel arch, is built across Canyon Padre, on Highway No. 66, by Arizona State Highway Department. Structure across chasm 100 ft. deep has span of 180 ft. and carries concrete roadway.

ALL-STEEL HOUSE (left and below) of low cost is built by Blaw-Knox Co., of Pittsburgh, at Clairton, Pa., near new Irvin works of Carnegie-Illinois Steel Corp. Measuring 44 ft. 2 in. by 24 ft. 2 in. in plan, 6-room structure, on concrete block footings, consists of insulated steel panels of wall height, prefabricated in units either 40 or 20 in. wide. Panels consist of welded steel channel frame with interior and exterior surfaces covered with metal-clad 1-in. rigid insulation forming 3-in. air space. Copper-bearing formed steel sheets are laminated to insulation with asphalt cement. No cutting for windows or doorways.



FORT PECK DAM (below) on Missouri River in Montana, world's largest earth fill, is shown at stage when 81,000,000 cu.yd., of total of 100,000,000 cu.yd., of hydraulic fill had been placed by four dredges of U.S. Engineer Department. Riprap is being laid to protect upstream slope. Dam is 9,000 ft. long more than ½ mi. thick at base and will rise 242 ft. above river bed. Supplementary dikes or wing walls, extending westward 11,500 ft., will make earth barrier nearly 4 mi. long.

READY FOR TOPPING OUT. (below) Completed base of U. S. Bureau of Reclamation's Grand Coulee dam on Columbia River in Washington rises to average height of 177 ft. above bedrock. River flows through slots in central section of dam. Under new $34,442,240 contract, Consolidated Builders, Inc., will raise dam to height of 550 ft., involving placing of 6,000,000 cu.yd. of concrete, nearly double the yardage in Boulder Dam.

DO BUILDINGS COST TOO MUCH?

Photo, Aerial Explorations, Inc.

Itemized Analysis of 20-Story New York Office Structure Compares Expense for Materials and Labor

By ARTHUR F. COMSTOCK

Formerly Chief Estimator, James Stewart & Co., Inc., Contractors, New York City

IN THIS PROLONGED and continuing stagnation of building construction there is unquestionably a widespread feeling that costs are too high. We hear wild charges by prominent speakers to the effect that "building material prices have skyrocketed" and that "we are at the mercy of monopolies," and so on. Then we also hear occasionally that labor rates are too high. The only charge that has not been seriously made so far is that contractors' profits are exorbitant. But most of the talking seems to emanate from professors or others not engaged in the construction business. The purpose of this article is to consider the facts in the light of some actual detailed experience in the construction field, and to attempt to stimulate discussion among those most concerned, so that we may, at least, locate causes before we begin to treat effects.

Building construction costs, as is well known, consist of materials, equipment, labor, overhead and profit. Continued low volume of business has naturally forced the contractors to cut overhead (general office expense) to the bone. Likewise, contractors' profits have been, in general, so low in recent years as to have become almost a myth, as financial statements and income-tax reports attest. Therefore, in this discussion we are concerned only with the items of labor and materials.

Table 1 has been prepared, taking as an example a 20-story New York office building and breaking down the cost, as of Sept. 1, 1934, between labor and materials and in accordance with the sub-divisions or trades usually found in a contractor's estimate. The increased cost of labor has been calculated as of Jan. 1, 1938, from the data shown in Table 2, which shows the union labor rates at the times above mentioned. September 1934, has been chosen as a basis of comparison because, for a year or two prior to that date, there was a distress market wherein the producers were selling below the cost of production and the prices had no legitimate basis or foundation. This condition was fairly well ironed out and prices more nearly stabilized by the fall of 1934. The increased cost of materials likewise has been calculated as of Jan. 1, 1938, and has been taken largely from Table 3 in so far as it applies, although a complete list of all the minor materials involved could not be shown here. These material price changes are based upon the actual selling prices and not upon list prices. Considerable pains have been taken to verify these figures and to reconcile divergent data wherever it existed.

It should be admitted that other types of building, such as apartments, court-houses, schools, industrial buildings, hotels, etc., might show different ratios of materials to labor, and even another office building of different specifications and finishing materials might vary slightly from the figures shown. Yet the average is considered by the writer fair and typical for an office building on the 1934 wage scale.

It will be noted from columns (c) and (h), of Table 1, that the total

Table I . . . Typical First-Class New York Office Building, Tower Type

ANALYSIS OF COST BY TRADES

Showing Increase Jan. 1, 1938 over Sept. 1, 1934 (20 Stories; 530,000 sq.ft.; 6,670,000 cu.ft.)

	Labor and Materials as of Sept. 1, 1934		Labor Only % of Total	% Increase in Labor Jan. 1, 1938 over Sept. 1, 1934	Labor Increase % of Total	Materials Only % of Total	% Increase in Mat'ls. Jan. 1, 1938 over Sept. 1, 1934	Materials Increase % of Total
	Amount $	% of Total						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1. Excavation	$ 60,000	1.500	0.50	9.0	.04	1.00	10.0	0.10
2. Foundations	100,000	2.500	1.25	24.0	.30	1.25	5.7	.07
3. Brick Masonry	130,000	3.250	1.75	26.0	.46	1.50	6.8	.10
4. Fireproof Partitions	100,000	2.500	1.25	26.0	.32	1.25	4.5	.06
5. Carpentry	20,000	0.500	0.28	22.0	.06	.22	16.0	.03
6. Concrete Floor Arches	170,000	4.250	1.92	23.0	.44	2.33	9.2	.21
7. Cement Fill & Finish	100,000	2.500	1.15	24.0	.28	1.35	0.0	0.00
8. Waterproofing-Dampproofing	25,000	0.625	.28	25.0	.07	.345	9.5	.03
9. Roofing & Sheet Metal	30,000	0.750	.30	23.0	.07	.45	21.0	.10
10. Structural Steel	440,000	11.000	2.20	18.0	.42	8.80	11.1	.98
11. Cut Stone & Terra Cotta	200,000	5.000	1.50	22.0	.33	3.50	0.0	.00
12. Ornamental Iron & Bronze	130,000	3.250	0.65	25.0	.16	2.60	25.0	.65
13. Steel Windows	40,000	1.000	.25	25.0	.06	.75	11.0	.08
14. Venetian Blinds	13,000	0.325	.03	25.0	.01	.295	0.0	.00
15. Rubber & Cork Floors	25,000	0.625	.16	10.0	.02	.465	20.0	.09
16. Hollow Metal	120,000	3.000	.75	25.0	.19	2.25	20.0	.45
17. Plastering & Lathing	160,000	4.000	2.50	33.3	.83	1.50	14.0	.21
18. Glass & Glazing	28,000	0.700	.21	17.8	.04	.49	21.0	.10
19. Painting	55,000	1.375	.80	16.6	.13	.575	0.0	.00
20. Finish Hardware	30,000	0.750	.15	25.0	.04	.60	0.0	.00
21. Marble & Structural Glass	180,000	4.500	1.10	12.5	.14	3.40	3.0	.10
22. Tile & Terrazzo	40,000	1.000	.40	10.0	.04	.60	0.0	.00
23. Plumbing & Drainage	200,000	5.000	1.70	16.7	.28	3.30	12.0	.40
24. Heating & Ventilating	240,000	6.000	1.60	10.0	.16	4.40	14.0	.62
25. Electric Wiring & Fixtures	300,000	7.500	1.95	42.9	.82	5.55	13.7	.76
26. Elevators & Elev. Doors	370,000	9.250	2.77	0.0	.00	6.48	27.0	1.75
7. Sprinkler System	20,000	0.500	.10	16.7	.02	.40	10.0	.04
28. Air Conditioning	200,000	5.000	1.86	15.0	.28	3.14	17.0	.53
29. General Conditions	140,000	3.500	1.75	20.0	.35	1.75	12.0	.21
30. Plant & Equipment (General)	25,000	0.625	.09	25.0	.02	.535	8.0	.04
31. Insurance (General)	20,000	0.500	.00	—	.00	.50	4.0	.02
32. Surety Bond Premium	48,000	1.200	.00	—	.00	1.200	0.0	.00
33. Overhead (General Office)	121,000	3.025	.00	—	.00	3.025	0.0	.00
34. Profit	120,000	3.000	0.00	—	0.00	3.000	0.0	0.00
Totals	$4,000,000	100.000	32.00		6.28	68.00		7.73

$4,000,000 ÷ 6,670,000 = $0.60 per cubic foot, not including tenant changes.

Total increase in labor $\frac{6.28}{32.00} = 19.6\%$

Total increase in materials $\frac{7.73}{68.00} = 11.4\%$

	Total Cost Sept. 1, 1934	Total Cost Jan. 1, 1938
Total labor, 32% of $4,000,000	$1,280,000 × 1.196	= $1,530,880
Total materials, 68% of $4,000,000	2,720,000 × 1.114	= $3,030,080
Total labor & materials	$4,000,000	$4,560,960

Average increase of labor and materials = $0.084 per c u. ft., or 14.0%.

average increase in labor is 19.6 per cent and in materials is 11.4 per cent, making a total average increase in the building cost of 14.0 per cent, equivalent to $560,960, or 8.4c. per cubic foot of building, between Sept. 1, 1934, and Jan. 1, 1938.

In order to check the accuracy of this increase in cost the writer has investigated actual costs of other types of buildings which lend themselves to comparison because of repetitive characteristics of design, architecture, materials and size, with the results shown in Table 4.

We might examine also, in this connection, some of the various indices of building costs, as given in Table 5, to determine what increase they show during the period in question, although they are in most cases not applicable to any particular city. The writer questions their accuracy for any particular building because of the limited number of factors on which they are based or because they represent an average of several types of building. A cost is accurate only for a particular set of conditions at a particular time and in a particular place.

From the preceding comparisons it seems a fair and reasonable conclusion that 14.0 per cent average increase in the total cost of a New York office building, as deduced from Tables 1, 2 and 3, is accurate as of the dates shown.

Increase in Materials

In considering the average increase of 11.4 per cent in materials there is little evidence to justify such commonly heard expressions as "skyrocketing material prices." Referring to Table 3: Of the 41 items listed we see that 8 did not change, 7 decreased and 26 increased. There may be a few of the 26 which are too high, but who can say, without an exhaustive analysis of the particular industry involved? The following observations seem fairly obvious:

(1) Increased wages, strikes and reduced hours of work in shops must cause increased prices of the product.

(2) Those industries which had the most effective NRA codes appear still to have the firmest prices, but recent economic conditions seem to be altering this condition.

(3) Surpluses and reserves have been so depleted by the depression and various taxes that industries can no longer continue to sell at a loss and survive.

(4) Continued low volume of production must increase the selling price.

(5) If any of these prices is the result of monopoly or illegal practice the Government must know the remedy.

Increase in Labor

Building labor in New York is completely unionized, as indeed it is in most large cities. The rates of pay have been the highest and hours, perhaps, the most favorable in American industry, although unquestionably the work is not ordinarily as continuous as in other industries. Few contractors are opposed to this principle. But how does it happen that wages can be 15.8 per cent over 1926, 1 per cent over 1929 and 19.6 per cent over 1934, as shown in Table 2, and how are wage rates of today related to volume of building?

From examination of Table 6 we see disclosed the interesting fact that during the period under discussion, 1934 to 1938, volume of new building in New York City has averaged but 14.6 per cent of the volume for the year 1926, yet wages now average nearly 20 per cent higher at the end of the same four-year period than at the beginning and almost 16 per cent above 1926.

Voluntary Codes of Fair Competition

Starting under the impetus of NRA in 1934 we have seen practices, both unnatural and unhealthy, grow up in the building industry, among them the so-called "Voluntary Codes of Fair Competition." They have raised wages to exorbitant levels and reduced hours. Let us see how one of these

Table 2 . . . Wage Scales in New York City

COMPARISON BETWEEN YEARS 1934, 1937, 1926 AND 1929

Rates per Hour (3-Year)

	1934		Jan. 1, 1938		Increase	1926		1929	
	$	Hr.	$	Hr.	Per Cent	$	Hr.	$	Hr.
1. Bricklayers	1.50	(8)	1.88½	(7)	25.7	1.75	(8)	1.87½	(8)
2. Bricklayers — Tenders	0.90	(8)	1.14⅜	(7)	27.0	1.12½	(8)	1.23½	(8)
3. Carpenters	1.40	(8)	1.75	(7)	25.0	1.50	(8)	1.65	(8)
4. Cement Finishers	1.40	(8)	1.75	(7)	25.0	1.50	(8)	1.65	(8)
5. Electricians	1.40	(8)	2.00	(6)	42.9	1.50	(8)	1.65	(8)
6. Engineers, Hoisting	1.65	(8)	2.00	(7)	21.2	1.75	(8)	1.92½	(8)
7. Elevator Constructors	1.40¼	(8)	1.40¼	(8)	0.0	1.50	(8)	1.65	(8)
8. Iron Workers, Struct.	1.65	(8)	1.92½	(8)	16.7	1.75	(8)	1.92½	(8)
9. Iron Workers Orn.	1.40	(8)	1.75	(7)	25.0	1.50	(8)	1.65	(8)
10. Laborers, Common	.90	(8)	.95	(8)	5.6	.81½	(8)	1.03⅛	(8)
11. Laborers, Conc. Wkrs.	.93¾	(8)	1.14⅜	(7)	22.0	1.00	(8)	1.16⅜	(8)
12. Lathers, Metal	1.40	(8)	1.75	(8)	25.0	1.50	(8)	1.65	(8)
13. Painters	1.28½	(8)	1.50	(7)	16.6	1.50	(8)	1.65	(8)
14. Plasterers	1.50	(8)	2.00	(6)	33.3	1.75	(8)	1.92½	(8)
15. Plasterers, Tenders	1.06¼	(8)	1.42	(6)	33.3	1.21⅞	(8)	1.34	(8)
16. Plumbers	1.50	(8)	1.75	(7)	16.7	1.50	(8)	1.65	(8)
17. Roofers, Composition	1.28¼	(8)	1.60	(7)	24.8	1.37⅛	(8)	1.51¼	(8)
18. Roofers, Slate & Tile	1.57¾	(8)	1.86	(7)	17.9	1.68⅝	(8)	1.85⅝	(8)
19. Sheet Metal Workers	1.40	(8)	1.75	(7)	25.0	1.50	(8)	1.65	(8)
20. Stone Masons	1.56¼	(8)	1.88½	(7)	20.7	1.75	(8)	1.92½	(8)
21. Steam Fitters	1.50	(8)	1.65	(8)	10.0	1.50	(8)	1.65	(8)
22. Marble Setters	1.50	(8)	1.68¾	(8)	12.5	1.50	(8)	1.68¾	(8)
23. Tile Setters	1.43¾	(8)	1.56¼	(8)	8.7	1.50	(8)	1.68¾	(8)
24. Glaziers	1.40	(8)	1.65	(8)	17.8	1.50	(8)	1.65	(8)
Average (of 24)	1.373		1.661		21.0%*	1.435		1.643	

Increase, average Jan. 1, 1938 over 1926 = 15.8%

Increase, average Jan. 1, 1938 over 1929 = 1.0%

*In calculating these averages, each trade has equal weight, whereas in Table 1 the numbers of men employed in each trade are not equal, which accounts for difference between 21.0 and 19.6%.

organizations works and examine the results.

The unions in a certain trade sign an agreement with the contracting employers in that trade, increasing wages, perhaps reducing hours of work and prescribing certain artificial restrictions on both the workmen and the employers, thus affecting methods of bidding and general methods of doing business. The employers agree to allow the union business agent to select 50 per cent of the men sent to the various jobs, and any employer who does not sign this "voluntary" agreement must accept 100 per cent, or all of his employees, of the business agent's designation. In some cases, the employer, in order to engage in business at all, even has to post a surety bond with the union before he can obtain any men. In the enforcement of the code the union has almost equal representation with the employers in declaring violations and enforcing penalties for violations. The percentage of overhead to be figured is set-up in the code and numerous other restrictions made which artificially raise prices — all of this being done in the name of "fair competition." Is it "fair" to the man who pays — the owner?

Furthermore, what safeguards are provided to prevent an unscrupulous business agent from resorting to the several forms of "kick back" through social clubs, crap games or otherwise, so long as he has the unrestricted power of selecting men who are sent to the jobs?

Here is an instance of how these codes are used to promote "fair competition" in one trade: Within a few months after the code was operating the unit price quoted on a representative item in that trade jumped 57c. The raise properly chargeable to wage increase, materials and other costs was only 16c. Why the other 41c.?

Table 3 . . . Basic Materials for a New York Office Building

SHOWING CHANGES IN PRICES
FROM SEPT. 1, 1934 TO JAN. 1, 1938

(Prices are for materials delivered to the building)

	Per Cent Increase	Per Cent Decrease
1. Brick, common	8.7	
2. Face brick, light gray, smooth	2.9	
3. Backup Tile, 8 in.	5.0	
4. Partition Tile, 4 in., T.C.	4.7	
5. Lime, Masons, hydrated		7.4
6. Cement, Portland		10.6
7. Steel Bar Reinforcing	20.0	
8. Gravel	9.1	
9. Sand	no change	
10. Lumber, Pine, for forms	17.9	
11. Linseed Oil, boiled	5.5	
12. Lead, white		2.5
13. Turpentine		32.7
14. Plaster, finishing	20.0	
15. Plaster, neat	22.2	
16. Metal Lath and Furring Channels	17.0	
17. Structural Steel, fabricated	11.1	
18. Granite, gray, 4-cut	10.0	
19. Limestone, cut, machine smooth	no change	
20. Roofing, felt and asphalt	20.0	
21. Copper Flashing	25.0	
22. Miscellaneous Iron, fabricated	26.0	
23. Ornamental Bronze, fabricated	25.0	
24. Terra Cotta, architectural	10.0	
25. Marble, domestic Tennessee	5.0	
26. Structural Glass	no change	
27. Steel Windows, double hung		11.0
28. Steel Windows, Casement		20.0
29. Bronze Windows, double hung	no change	
30. Plumbing Fixtures	22.0	
31. Brass Pipe and Fittings	25.0	
32. Steel Pipe	5.0	
33. Pipe Covering	no change	
34. Cast Iron Pipe	no change	
35. Cast Iron Radiators		16.0
36. Sheet Metal, Galvanized	22.0	
37. Electric Conduit	17.0	
38. Wire, rubber covered	no change	
39. Switches and Receptacles	10.0	
40. Switchboards and Panels	25.0	
41. Underfloor Duct	no change	

Table 4 . . . Increase in Cost of Various Types of New York Buildings

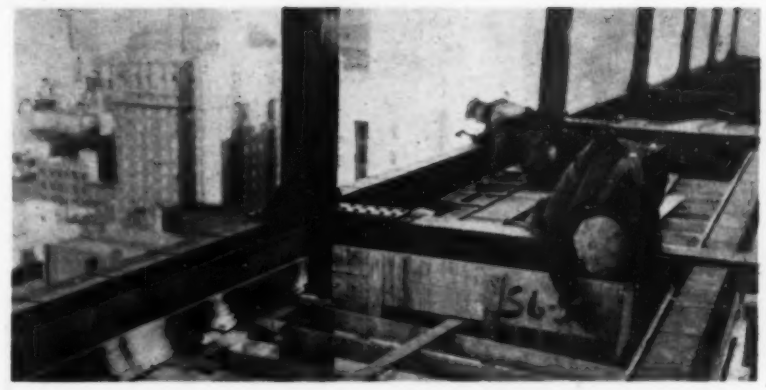
FROM SEPT. 1, 1934 TO JAN. 1, 1938

	Cost per Cubic Foot Sept. 1, 1934	Jan. 1, 1938	Per Cent Increase
Schools, Elementary	$0.46	$0.53	15.3
Fireproof Apartments, 12-Story	$0.44	0.51	15.9
Semi-Fireproof Apartments, 5-Story Walk-up	$0.31	0.36	16.1
Office Buildings (See Table 1)	$0.60	0.684	14.0

Table 5 . . . Comparison of Various Building Cost Indices

SHOWING INCREASED COST BETWEEN SEPT. 1, 1934 AND JAN. 1, 1938

(From Engineering News-Record "Construction Costs.")	*Per Cent Increase*
Engineering News-Record — Construction in general, national average	23.7
American Appraisal Co. — Buildings, New York City, 4 types	9.5
Turner Construction Co. — Buildings, Eastern Cities, average	21.4
Aberthaw Construction Co. — Buildings, New England, average	11.0
Tuttle — Buildings, Eastern Cities, average	17.9
Average of five indices above shown	16.7
New York office building—see Table 1	14.0



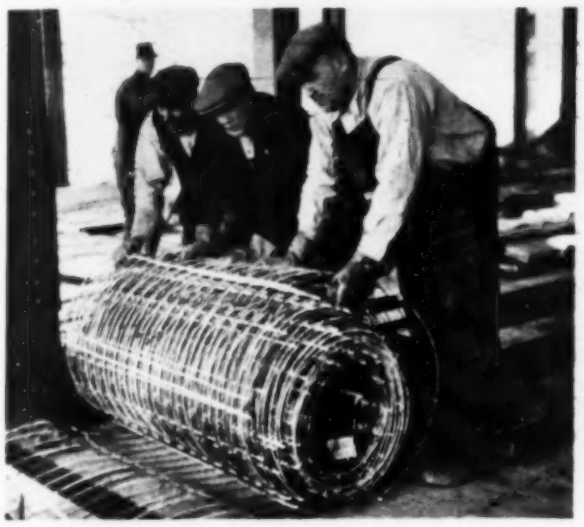


Table 6 . . . Volume of Building Construction in New York (Five Boroughs)

(FROM STATISTICS OF F. W. DODGE CORP.)

Year	*Volume*	*Per Cent of 1926*
1926	$1,025,080,600	100.0
1929	688,876,000	67.0
1930	502,285,800	49.0
1931	362,830,800	35.4
1932	62,585,100	6.1
1933	73,745,300	7.2
1934	78,342,600	7.6
1935	128,195,000	13.4
1936	66,939,900	16.2
1937	$218,130,100	21.3

*Average 14.6% of 1926 for 4 years.

To whom is this sort of thing fair? Certainly not to the owner of a building who pays the bills. Does anyone pretend that practices as just outlined increase the amount of building, or contribute anything of value to the long-range or even the immediate interest of the building business?

While, so far, there are only four or five trades operating in New York under these codes, the increases in wages and reduction of hours have spread to other trades, and there is already talk of other increases when agreements expire. The electrical trade has been the prime mover in operating under "Voluntary Codes of Fair Competition," not only in New York but in some other large cities. In New York, the electricians were the first to go to the 7-hr. day (Nov. 7, 1934), the first to go to the 6-hr. day (Aug. 27, 1936), and the third to go to $2 per hour (Jan. 1, 1938).

One cannot read a "Voluntary Code of Fair Competition" and the agreement underlying it, and contemplate all of its altruistic provisions (at the owner's expense), without marveling at the modesty, the restraint and the ingenuity of its authors. At least they did not claim that these codes were taken from the Old Testament; neither did they claim that they constitute a course in character training for American youth.

Efficiency of Workmen Under Reduced Hours

In checking up on the performance of building craftsmen under the 6- and 7-hr. day, as against the former 8-hr. day, the writer has found the consensus of best-qualified opinion to be that the work done per hour has not diminished. Of course, it has been fundamental that efficiency of workers has been highest when volume of business has been lowest. On the other hand, building craftsmen, in general, have been efficient and the exceptions, if any, have been the pipe trades. It is perhaps significant that it is the pipe trades which have been most active in promoting the "Voluntary Codes of Fair Competition."

Conclusions

The conclusions which the writer draws from this discussion are as follows:

(1) Building material prices, since 1934, with few exceptions, have not increased unduly, considering all of the factors involved, especially increased shop wages.

(2) Building labor rates have increased beyond the economic trend of the times. A decrease is required.

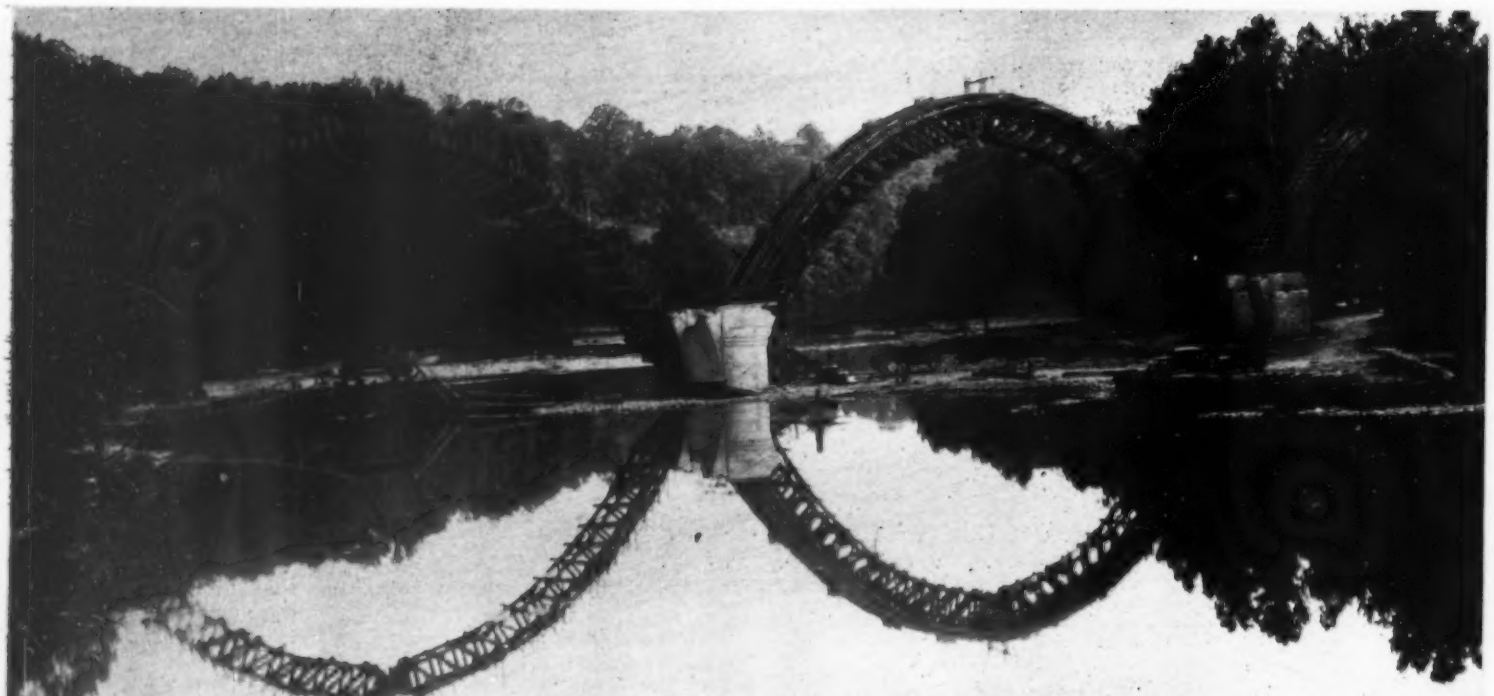
(3) "Voluntary Codes of Fair Competition" are detrimental by setting up artificial restraints, unduly raising wages and prices, thereby curtailing the volume of private building, and are giving the industry a bad name.

(4) Contractors' organizations will have to be more active, more articulate and more adamant in protecting the public interest as well as building interests, by opposing further unwarranted wage increases and restrictions, even to the extent of refusing to sign agreements which further penalize the property owners. A wage reduction is required.

(5) There is definite need of more active debate and discussion of all these matters, particularly by contractors, in order that corrective measures may be based upon a correct diagnosis and not upon the theories and whims of uninformed or prejudiced parties.

(6) Basic improvements in building construction unemployment cannot result from economic fallacies, from Government building programs, or from coercive methods, open or disguised.

(7) Union labor is definitely in need of more intelligent leadership which truly represents honest American traditions and the real and permanent interests of the workman. Union labor has been too aggressive for its own good.



Largest Timber Arch Centers

Support Rib Forms on Ohio Bridge

CONSTRUCTORS of the third largest state highway bridge in Ohio, a Federal aid project at Foster, 23 mi. northeast of Cincinnati, utilized the largest timber arches ever designed for bridge centering in the United States. The W. L. Johnson Construction Co., Hicksville, Ohio, is contractor for both bridge and approach work on the $500,000 project, which involves six spans of two-rib open spandrel concrete arches supporting a concrete deck structure having a 24-ft. roadway and 3-ft. sidewalk. Four central spans bridge the Little Miami River.

Arch spans vary from 155 ft. to 175 ft., center to center of piers, with a clear rise above springing line of about 72 ft. Ribs are spaced 18½ ft. on centers, each rib being 6 ft. wide and varying in thickness from 4 ft. at the pier lines to about 2½ ft. at the crown.

Timber Arches — Timber three-hinged arches, using Teco split ring connectors at the truss joints, supported the formwork for the arch ribs. The contractor selected an arch type of centering to provide clearances for railroad and highway underpasses and for possible floods in the river. Use of timber permitted fabrication on the site by the contractor's regular forces, as well as reuse of much of the arch centering material in the falsework for the deck structure.

Teco timber connectors have been used on many modern timber bridges throughout the country, but the Foster bridge project was the first large arch centering job to employ them. Centering for each span consisted of two three-hinged arch trusses laced together to form the support for one concrete rib. After one rib of a span had been concreted, the trusses were shifted sideways into position for the second rib.

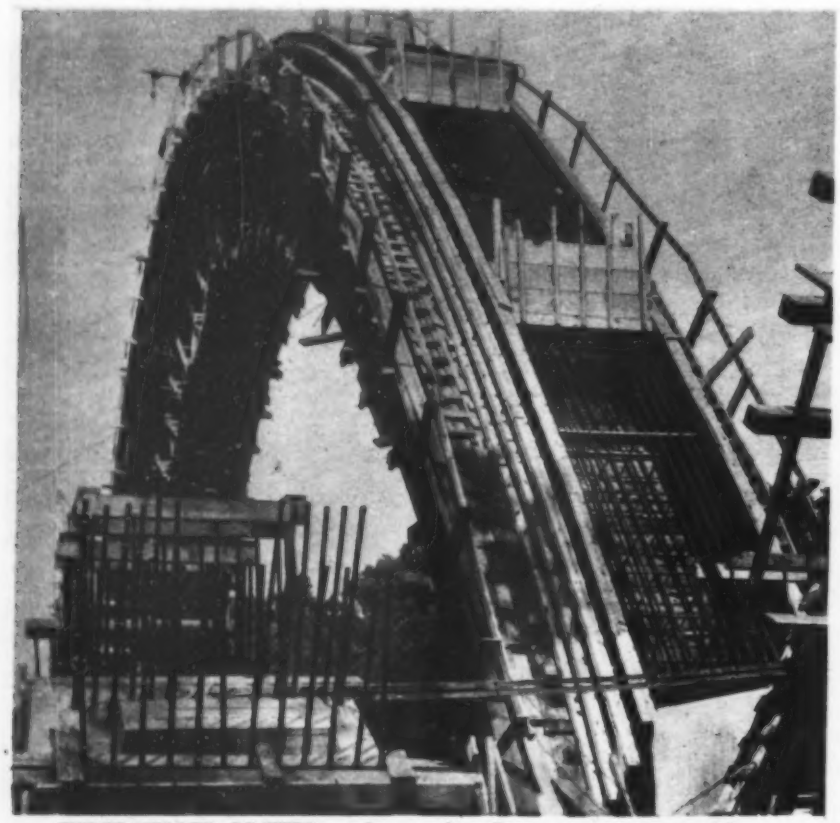
Fabrication — No two arches have the same span. This condition, plus Highway Department specifications on concreting sequence, required construction of falsework arches for five spans. The arches for the first span were altered for use in the sixth span. All arches were designed to permit maximum duplication of layout and joint details. Timbers for the arches were cut to exact length in the lumber dealer's plant, enabling the contractor to handle fabrication with a minimum of equipment. Structural grade Douglas fir was used for all structural members in the trusses, and local hardwood timbers, milled on the job, were employed for posts and sills supporting the lower hinges.

Erection — Arch erection methods varied with conditions on the individual spans. In setting the first span, over the highway, the two ribs of each half span were raised independently, temporarily supported on shear legs and latticed together in the air. The center hinge was then made by jacking. Similar procedure was followed on the sixth arch, over the railroad. Traffic was uninterrupted in either case. On the other arches the two ribs of each half were completely assembled on the ground, with the lower hinge points in position, and the two halves were raised in succession and lowered to position to make the center hinge connection. A gallows frame and two cranes set the largest span (157 ft., center to center of hinges, 60-ft. 9-in. rise); a gantry boom and one crane were used in setting other spans.

Formwork was built upon the supporting ribs and was blocked up to the line of the finished concrete. All rib forms are lined with plywood. In shifting centering, side forms were removed, and the entire falsework was dropped clear of the concrete by lowering the hinges at the springing line. Arches then were easily jacked sideways on pipe rollers to the position of the second rib.

Administration — The bridge and approaches are being built by the Ohio Department of Highways. Fred I. Rowe heads the W. L. Johnson Construction Co., and D. H. Criswell is job superintendent.

Carlton, Frankenberger and Batson, consulting engineers and architects, Cincinnati, Ohio, designed the timber arch centering, as well as the falsework for the roadway structure. Teco split rings and assistance in fabricating the trusses were supplied by the Timber Engineering Co., Washington, D. C.

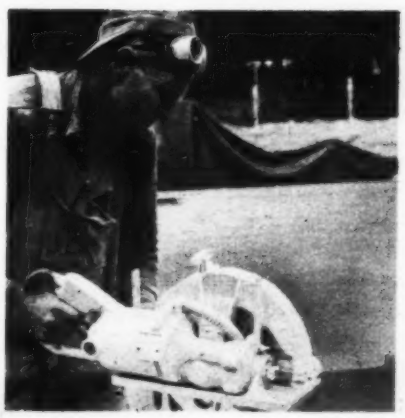


THREE-HINGED ARCHES made up of timber trusses framed with split ring connectors carry rib forms on spans 155 to 175 ft. long of bridge across Little Miami River at Foster, Ohio.

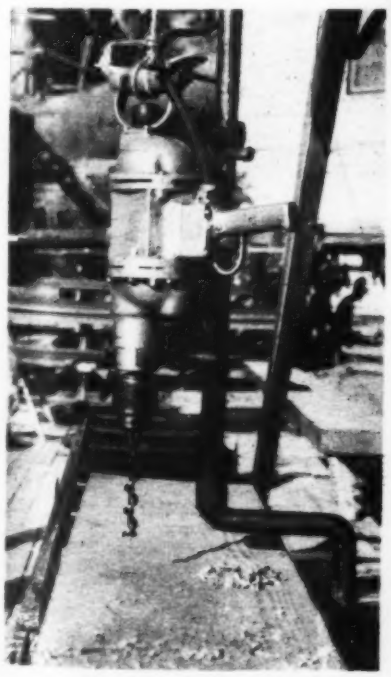
Truss Fabrication for Timber Arch Centers

1 **WOODEN TEMPLETS** for individual members of timber arch trusses are laid out on deck to permit locating and drilling holes.

2 **CARPENTERS** use templet, nailed temporarily to timber, to locate bolt holes and end cuts. Punch with center point marks each bolt hole. Grooving instructions for each hole, shown on templet, are transcribed on timber.

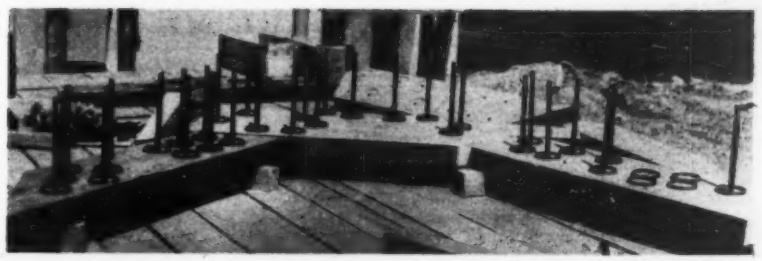


3 **PORTABLE POWER SAW (right)** cuts timber to shape. Where saw does not cut through piece, timber is marked and cut from opposite faces of member.

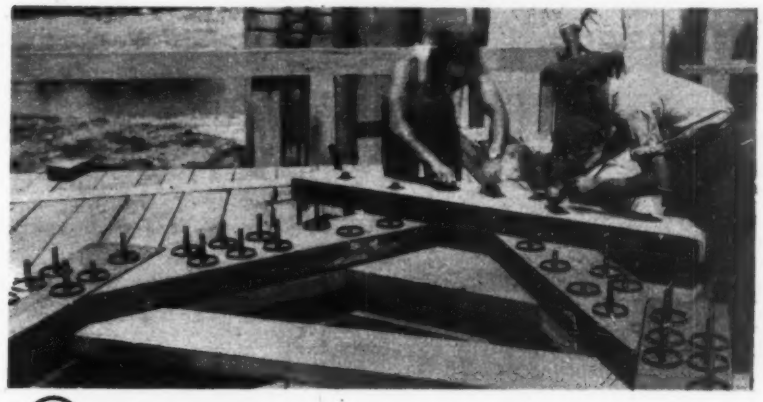


4 **POWER DRILL** locked in radial mounting over roller table assures vertical boring of holes necessary for good fit and easy assembly.

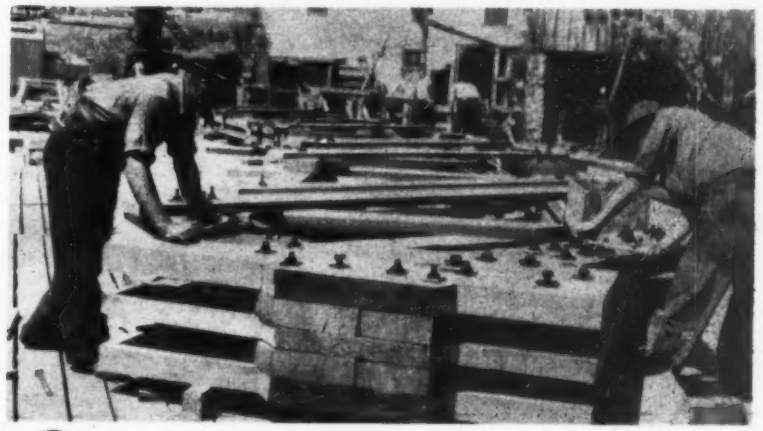
5 **GROOVING BIT** driven by ¾-in. electric drill at 320 r.p.m. cuts 4-in.-diameter grooves for split ring connectors.



6 **INITIAL MEMBERS** of truss, fitted with bolts and connectors, are laid in respective positions.

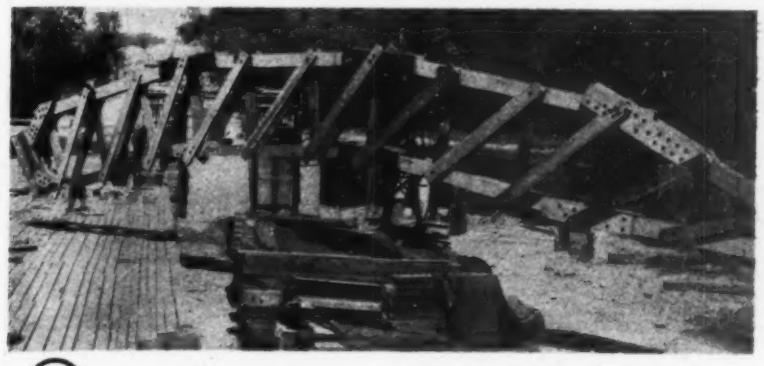


7 **TRUSS ASSEMBLY** is built up to take final members, one of which is being bolted in place.

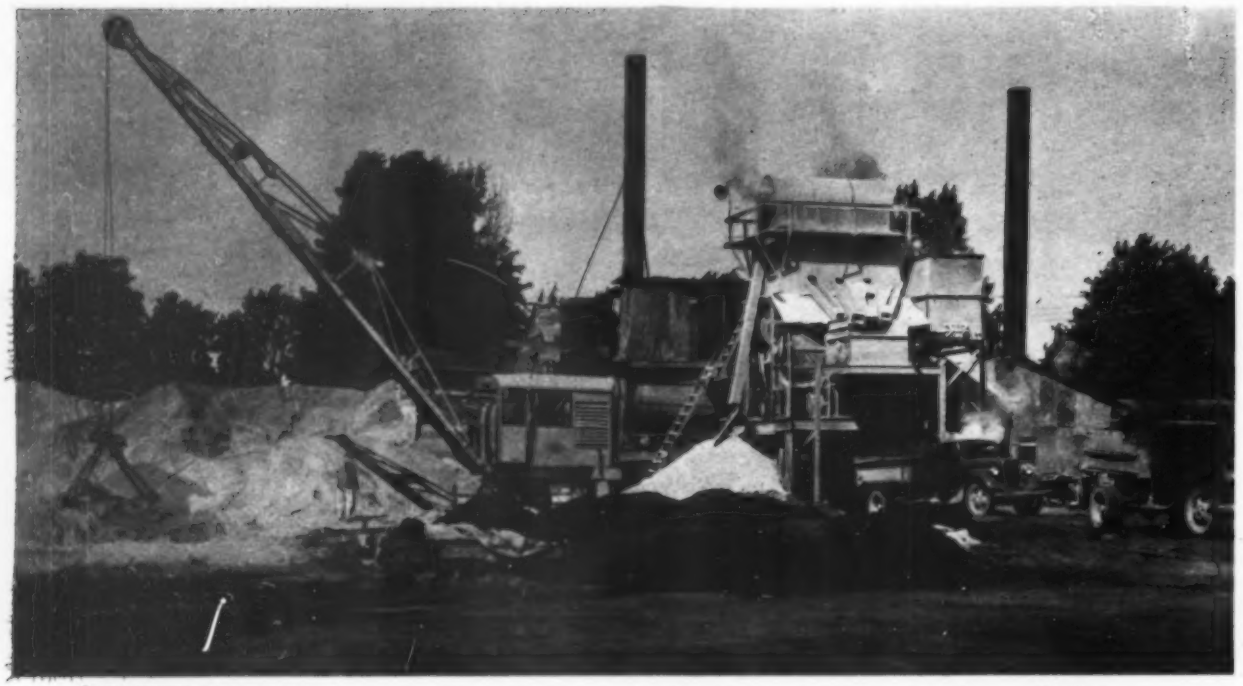


8 **RATCHET WRENCHES** tighten bolts after timber assembly has been completed.

9 **WITH FABRICATION COMPLETED,** truss is ready to be lifted from temporary position on deck.



10 **CRAWLER CRANE** picks up 80-ft. truss to be used in one half of three-hinged arch.



CLAMSHELL CRANE feeds aggregates to primary supply bin of mixing plant and loads premixed material into trucks out of overnight stockpile, remnants of which can be seen in foreground.

Plant-Mix Oil Aggregate Surfacing

Paves Michigan's Secondary Roads at Low Cost

UTILIZING LOCAL GRAVEL, which is available through practically the entire state, to pave and preserve secondary roads having good gravel bases, the Michigan State Highway Department has developed a plant-mix version of the oil aggregate road-mix surfacing employed with great success in several Western states. By its controlled procedure Michigan puts a 2½- to 2¾-in. two-course wearing mat of assured quality on secondary roads for $4,500 to $5,000 a mile and, at the same time, gains certain additional advantages which are of great value in meeting construction conditions encountered in the state. A representative example of this type of construction is furnished by two connecting contracts totaling 23½ mi. on State Road 76, between Kalkaska and Grayling, built as a unit by the Detroit Asphalt Paving Co. last summer and fall at an aggregate contract bid price of $110,350, an average contract price of $4,700 per mile. Unit prices are given in an accompanying table.

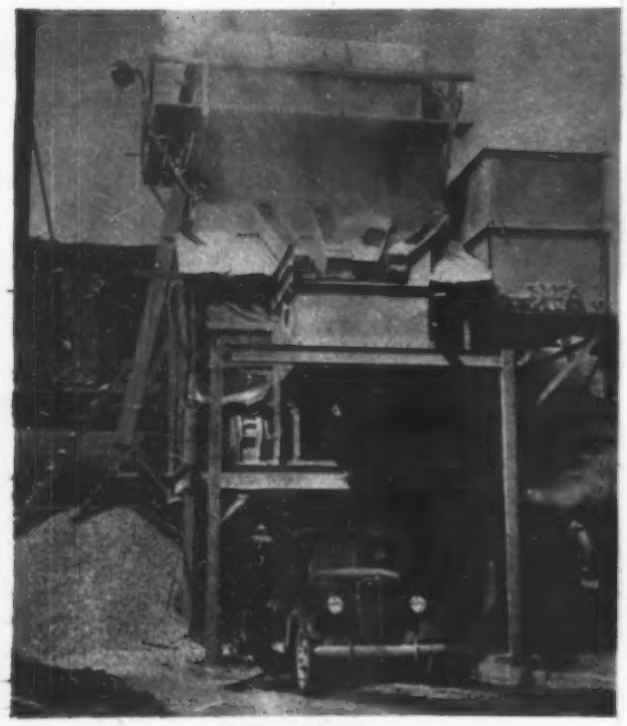
Advantages of Plant-Mix — Michigan uses plant-mix rather than road-mix in order to dry aggregates and permit contractors to operate continuously despite an average of perhaps two rains a week through the construction season. Although the cost is slightly higher than road-mix, the plant-mix process gives accurate control of materials and finished mixture. All materials are measured by weight.

By using mechanical spreaders to place the mixture in half widths of the roadway, the Highway Department is able to keep roads continuously open to the heavy summer traffic while building oil aggregate pavement. This advantage is particularly important in the northern part of the state, the region of heaviest tourist travel, where few good detours are available. Plant mixing permits a considerable extension of the construction season, as made evident in 1936, when the oil aggregate jobs ran up to December, even in the frigid upper peninsula of the state.

Michigan Experience — In 1936, the State Highway Department completed 237 mi. of oil aggregate surfacing with WPA labor. This pavement made a highly satisfactory record during its first year in service. In this time, the surface oxidized and took on a pleasing gray color. None of the mileage constructed in 1936 required a seal coat during its first year.

Oil Aggregate Surfacing—Proportions of the mixture

OIL AGGREGATE SURFACING of Michigan gravel road is completed on 23½ mi. between Kalkaska and Grayling under supervision of (left to right) W. S. MOORE, project engineer; S. A. BAKER, assistant road construction engineer, Lansing; and JESSE GREGORY, inspector.



PLANT MIXING of oil aggregate surfacing material permits resumption of operations soon after rain. Ingredients are proportioned by weight.

PLATFORM SCALE (right), weighs each load leaving asphalt plant, eliminating batch miscounts and furnishing check on batch weights. Weighbeams are inclosed in house at left of platform.

are controlled by the research and testing laboratory, Ann Arbor, Mich., a branch of the State Highway Department. The plant inspector and assistant plant inspector at the asphalt plant are representatives of this laboratory. For the two adjacent contracts of the Detroit Asphalt Paving Co. on State Road 76, the laboratory designed a 2,000-lb. batch in the following proportions: 800 lb. of coarse aggregate (100 per cent passing ¾-in. square-opening screen and 100 per cent retained on No. 10 sieve), 1,018 lb. of sand (100 per cent passing No. 10 sieve), 110 lb. of dust (about 87 per cent passing No. 200 sieve), 72 lb. of slow curing asphaltic oil. On the job, where sand and gravel were separated by ¾- and ¼-in. screens at the top of the asphalt plant, actual weights used in batching the two sizes were adjusted to give the proportions fixed by the laboratory. The materials were mixed 10 sec. dry and 35 sec. wet, a total mixing time of 45 sec.

Michigan specifications require a high quality slow curing asphaltic oil designated as SC-4A, which will pass the heterogeneity test. It is believed that the slight additional cost of this quality of oil will be more than offset by a longer service period of the surface mat.

To avoid burning the light asphaltic oil, temperature of the aggregate is limited to 250 deg. Specifications do not require a recording pyrometer, but the plant at Kalkaska was equipped with an indicating pyrometer, showing temperatures in the boot of the hot sand elevator, to assist the operator feeding aggregate to the cold sand elevator. Neither timelock nor batchmeter is specified for oil aggregate surfacing, but on all types of bituminous paving in 1937 the state required a platform scale to weigh loads leaving the plant. The contractor furnished the scale and the state supplied the scale man.

On the road, the oil aggregate mixture was spread and rolled in two courses in order (1) to get better rolling of the soft mixture in thin layers and (2) to gain double value from the leveling action of the mechanical spreader, which reduced irregularities in a 1 to 4 ratio at each spreading.

Asphalt Plant — A complete asphalt batching and mixing plant with a maximum capacity of 60 tons an hour was set up adjacent to a railroad siding in Kalkaska, a distance of 26½ mi. from the farthest point of the combined contracts. The plant had to operate about 15 hr. a day to produce sufficient mixture to supply the mechanical spreader working about 13 hr. on the road. In its 15-hr. working days, the plant averaged 800 to 900 tons of oil aggregate surfacing material, of which 150 to 180 tons was stockpiled over night in the yard to be loaded out by clamshell crane during the following day.

Two 13,000-gal. cylindrical tanks erected on concrete piers and a 3,000-gal. tank on the mixing plant held sufficient asphaltic oil to maintain production during any normal interruption in railroad delivery. Fuel oil for the operation of two Hauck ¾-in. burners in the dryer and one Best ½-in. burner in a 75-hp. Scotch marine boiler was stored in a 6,000-gal. tank. Except after rains, only one of the two burners was operated in the dryer — a rotating steel cylinder 6 ft. in diameter by 30 ft. long.

Electric motors drove all mechanical motions of the asphalt plant, including the Farasey twin pugmill mixer.

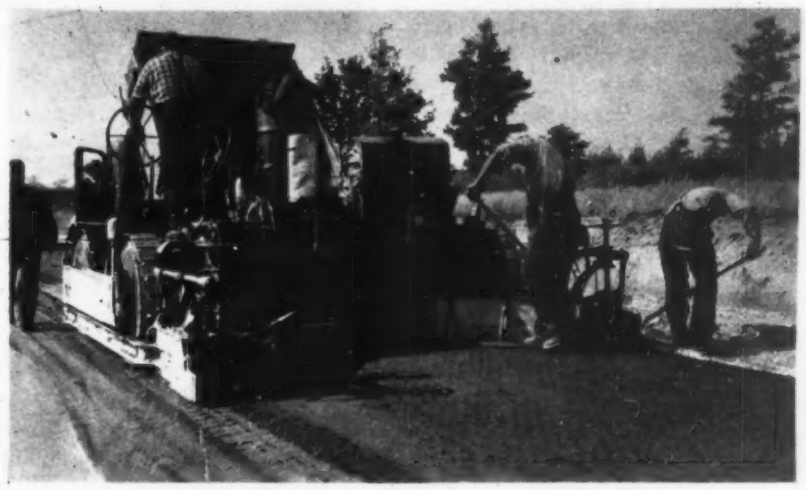
Batch Hauling — An average fleet of 22 trucks, rented by the hour, hauled material from the asphalt plant to the road. Most of these trucks were Fords and Chevrolets of 1½-ton rated capacities, hauling 5 tons per trip. Two or three trucks of this capacity, equipped with extra long boxes, hauled 6 or 7 tons, and a few trucks which had been fitted with tandem rear drive axles on dual pneumatic tires carried 9 tons per load.

Mechanical Spreader — Each of the two courses for the 2½-2¾-in.

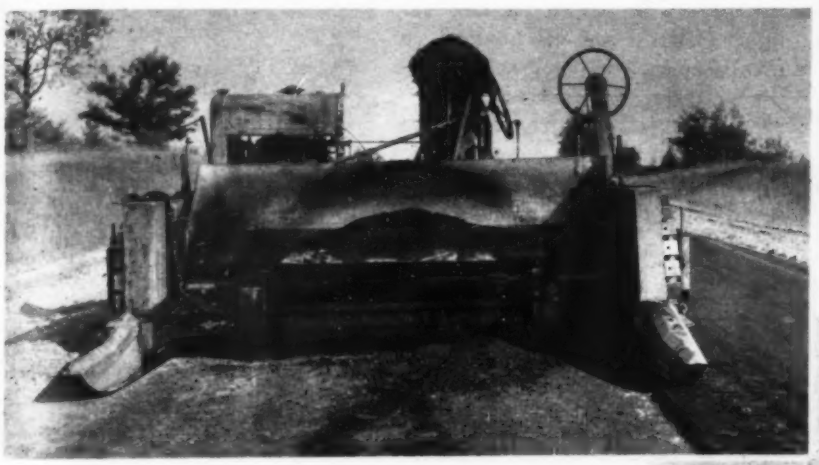
Contract Prices and Total Quantities
FOR TWO ADJOINING PROJECTS

	Total Quantity	Unit Price	Amount
Condition existing road surf., mi.	23.5	$50.00	$1,175.00
Prime coat, gal.	94,000	.09	8,460.00
Oil aggregate surfacing, tons	35,250	2.77	97,642.50
Oil aggregate in stockpile, tons*	1,175	2.62	3,078.50
		Total	$110,356.00

* Oil aggregate in stockpile is mixed material stored on project for future maintenance.



DIAGONAL STRIKE-OFF at rear of spreader blends material into center-line joint between paving strips.



DIFFERENCE IN GRADE between two sets of runners is compensated by adjustment in oscillating screed. Screw-type spreader in hopper of machine distributes material just ahead of screed.

LONGITUDINAL ROLLING (right), of each course begins after edge has been banked with shoulder material.

AT ASPHALT PLANT, camera catches W. PETERSON (left), assistant superintendent for Detroit Asphalt Paving Co., and B. B. MILES, plant inspector.

depth of 20-ft. pavement was spread in half widths by a Jaeger self-propelled mechanical spreader, which traveled toward the asphalt plant to permit rolling to be carried on in back of the spreader without interference from trucks hauling the mixture. The strike-off screed of the spreading machine was adjusted to give a yield in pounds per square yard of about one-half the total amount specified, 250 lb. per square yard. The halved yield was expected to give a depth of about 1¼ in. Specifications prohibit spreading to a depth of less than 1 in. in either top or bottom course but state that the intention in constructing oil aggregate surfaces is to spread the material according to an average yield in pounds per square yard rather than to a constant depth.

A long, sled-like frame running on the roadway grade, suspended by spring tension from the chassis of the mechanical spreader, acted as a leveling device in removing inequalities in the pavement. A reciprocating strike-off screed operated in this suspended frame. Trucks end-dumped their loads of oil aggregate mixture into the receiving hopper of the mechanical spreader, which placed the material on the grade by means of a roll feeder consisting of revolving fins on a shaft at the bottom of the hopper. To avoid spillage of the material on the grade, the trucks did not move forward under their own power during the dumping operation but allowed the mechanical spreader to push them forward as it traveled ahead.

BASE COURSE is completed several miles in advance of top course to allow time for compaction under traffic.

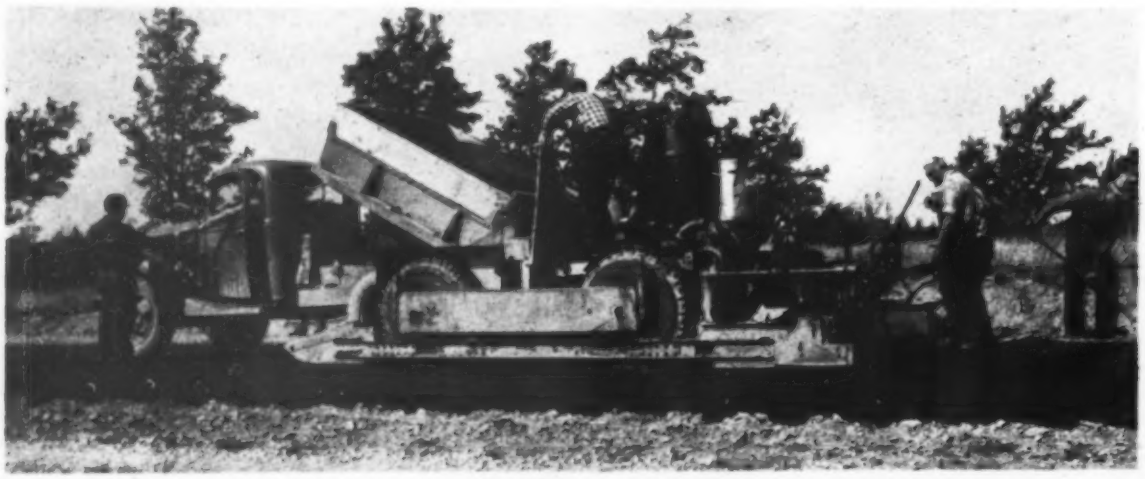
Base Prime — Prior to the placing of the first course of oil aggregate surfacing, the existing gravel grade was wetted where necessary by a 2,000-gal. tank truck which supplied water to the road through a gravity-flow distributor pipe. The base then was shaped to about 1½-in. crown by an Austin-Western long-wheel-base motor patrol unit.

On a shaped gravel base (of 21-ft. width and 5-in. minimum compacted thickness) the contractor sprayed a prime coat of medium-curing asphaltic oil at the rate of .25 to .33 gal. per square yard. To minimize interference with traffic a pressure distributor applied the prime to one-half the road at a time, allowing the first side to dry for 24 hr. before oiling the second. Specifications prohibited placing oil aggregate until the primed surface had cured at least 48 hr. Small holes in the primed surface were filled with oil aggregate well in advance of the spreading operations to allow traffic to compact the material.

Lower Course — A line to guide the spreader in placing the first half of the base course was marked on the pavement and was kept at all times several hundred feet in advance of the spreader. After the machine had laid 500 or 600 lin. ft. of base course on one-half the road, it moved back and brought up the other half. Base was laid several miles ahead of top course to allow traffic to compact the material and produce a smooth, stable surface to support the spreader when laying top.

As soon as the mixture had cooled sufficiently to be stable when rolled, a steam 8-ton tandem roller went over the surface once. Before rolling began, the outside edge was banked with shoulder material, and the edge of the roller lapped 6 in. beyond the edge of the pavement when starting the rolling operation. Both the base course and the top course were rolled once longitudinally with the 8 ton roller to prevent formation of wheel marks and to seal the surface for rain runoff.

Top Course — Dips or sags in the base course were corrected by the addition of oil aggregate mixture, hand raked to the proper grade and feathered out at the edges. Large patches of this sort were compacted



SELF-PROPELLED SPREADER takes mixed material from dump trucks and strikes it off to proper depth on half of roadway.

INDICATING PYROMETER (below), protected by improvised metal hood, guides operator in regulating aggregate feed to cold sand elevator.

IN LAYING SECOND HALF of each course **(left),** inside semi-crawler wheels of spreader travel on completed first half. To avoid spillage of material on pavement, truck throws out clutch and allows spreader to push it forward until emptied.

by rolling, while small patches were hand tamped. On a dry, well graded base course, swept clean with brooms where necessary, the mechanical spreader placed the upper layer of oil aggregate surfacing at the rate of 125 lb. per square yard, using the same mixture as in the base course.

Special care was taken to obtain a well blended and evenly matched center joint, and transverse joints were carefully raked and smoothed to assure good riding qualities. Tapered transverse joints, left standing over night or longer, were trimmed to form a square vertical cut across the section, and the spreader was moved back far enough to allow the strike-off bar to be lowered almost flush with the surface just back of the square joint. After the spreader had moved forward, the inspector checked the joint with a 10-ft. straight-edge, and workmen adjusted the joint to grade by hand raking. A light sprinkling of oil aggregate screened through a ½-in. screen assisted in blending the joint and in producing a smooth, dense surface exactly conforming to the adjoining surface. As much care was taken in the construction of base course joints as top course joints.

Paving Progress — A full working week consisted of six days of about 13 hr. each. In an average day, the paving crew laid 750 tons of oil aggregate mixture, equal to 1 mi. of one-course pavement. Between daylight and dark on Sept. 17, the crew laid 922 tons in 1¼ mi. of single-course construction, 20-ft. width.

Smoothness — Although oil aggregate surfacing is not expected to equal in smoothness the higher type pavements, it is required to have a smooth riding surface which in general does not vary more than ¼ in. in 10 ft.

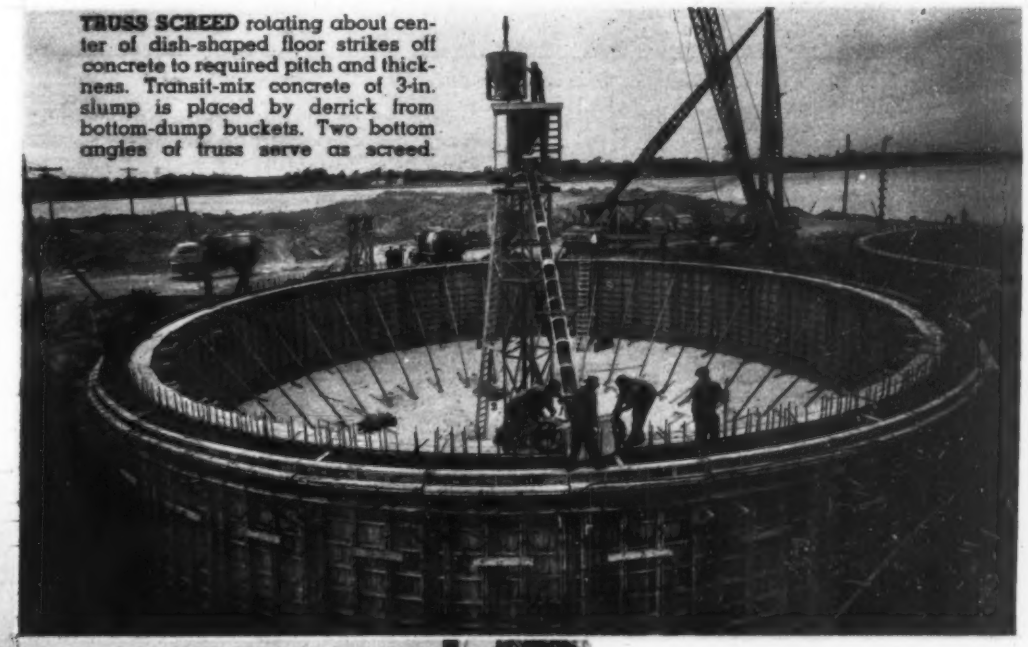
Administration — Murray D. Van Wagoner is state highway commissioner and chief executive officer of the State Highway Department. By a mutually satisfactory exchange of positions which gave each of them the type of work particularly fitting his training and interest, V. B. Steinbaugh last fall became deputy commissioner-chief engineer, and Harry C. Coons became deputy commissioner in charge of construction and operation. Supervision of the oil aggregate surfacing program is delegated in great part to J. G. Schaub, assistant to the deputy commissioner in charge of construction and operation. F. T. Olmstead, field testing engineer of the research and testing division, is responsible for the proportioning and control of the mixtures on oil aggregate work. On the two contracts described in these notes, W. S. Moore was project engineer, and B. B. Miles was plant inspector.

For the Detroit Asphalt Paving Co., contractor, A. P. Hanan is general manager in charge of these and other contracts. During Mr. Hanan's absences from the work, W. Peterson, assistant superintendent, was in complete charge.

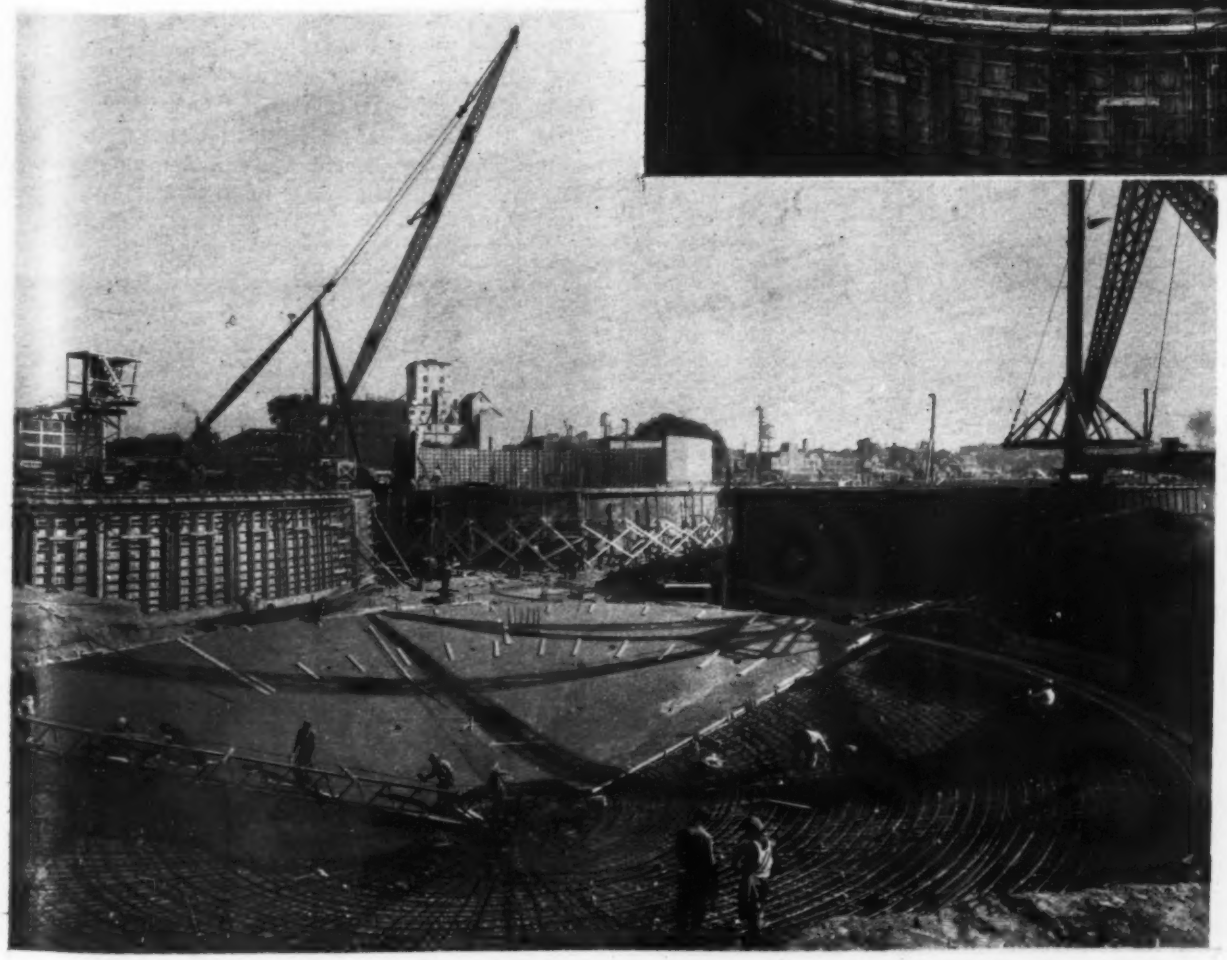
Rotating Rigs

Facilitate Concreting of

Circular Tanks



TRUSS SCREED rotating about center of dish-shaped floor strikes off concrete to required pitch and thickness. Transit-mix concrete of 3-in. slump is placed by derrick from bottom-dump buckets. Two bottom angles of truss serve as screed.

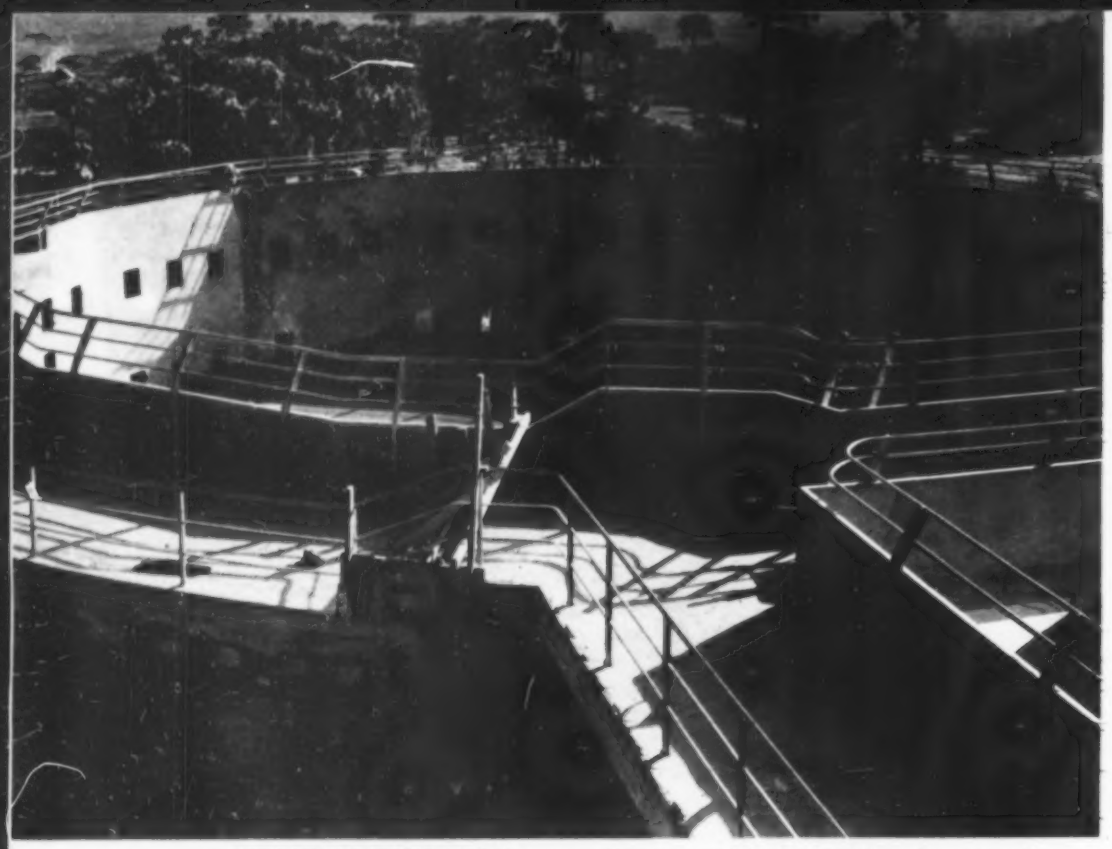


WHIRLIGIG CHUTE revolving about central tower permits placing concrete in uniform lifts around tank circumference. Plywood backstop carried by man at lower end of chute prevents spillage.

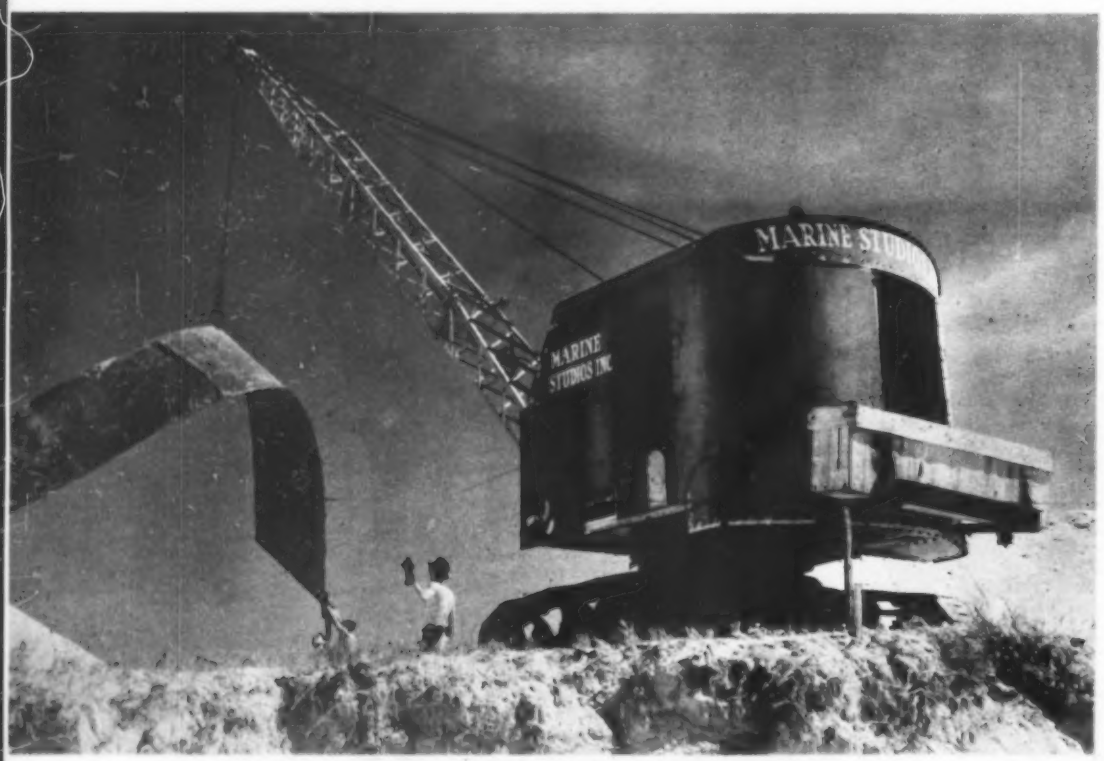
TWO ROTATING RIGS devised by John Masoni, superintendent for Lombardo Bros. Construction Co., Cleveland contractor, screeded the conical bottoms and delivered concrete to the wall forms of circular sludge digestion tanks at the Buffalo, N. Y., sewage treatment works. The tanks are 90 ft. in diameter, with 10-in. concrete floors pitched on 1:4 slope and walls 12 in. thick and 20 ft. high.

A lattice truss screed was made up of two top and two bottom angles, 2½x2½x¼ in., 2 ft. 4 in. back to back and 46 ft. long, braced by two 1⅜-in. hog rods. The truss was supported at the lower end on a pipe pin. At the outer end it was carried by two tandem wheels riding on concrete wall base. A tractor was hooked to this end to rotate the screed.

Wall concrete was placed by a whirligig chute supported in a rotating hopper frame on a steel tower and carried by two pneumatic-tired wheels traveling on a runway.

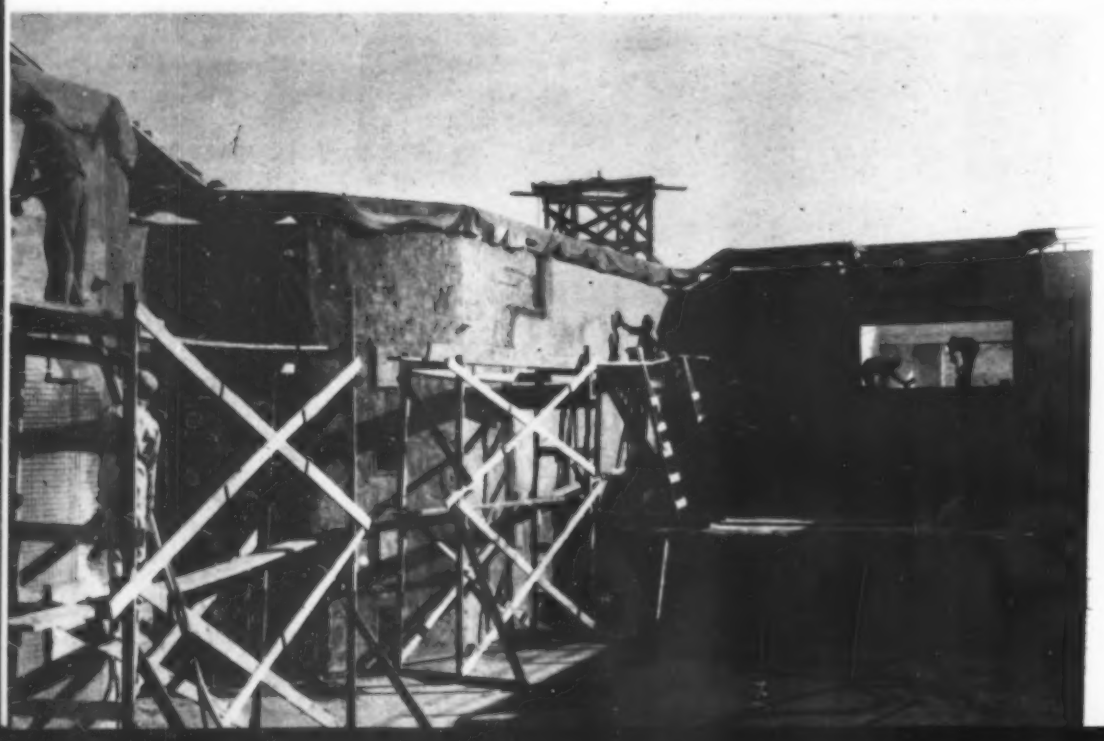


WELDED CIRCULAR TANK 75 ft. in diameter and 11 ft. deep has two rows of observers' port holes in side walls lined with Gunite on steel plate.



CRAWLER CRANE handles steel during erection of tanks and later transfers giant fish and other marine specimens from boats to aquaria.

TANK LINING (below) 1¾ in. thick of sand, cement and water, reinforced with welded wire mesh, is applied at 100-lb. pressure by Gunite equipment.



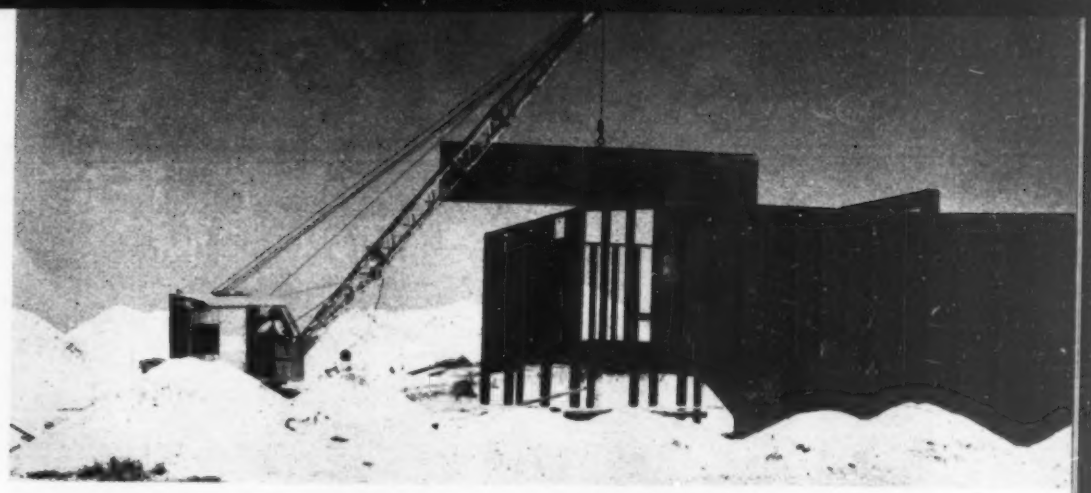
Electric Welding *Seals Joints of* Steel Aquarium Tanks

ELECTRICALLY welded steel tanks lined with Gunite and equipped with sealed glass port holes in sides and bottom form watertight containers for the two largest aquaria and the world's only specially designed underwater motion picture studio, completed and recently opened by Marine Studios, Inc., at Marineland, on the ocean shore 18 mi. south of St. Augustine, Fla. A rectangular tank 100 ft. long, 40 ft. wide and 18 ft. deep has both ends of its floor slightly raised and supported on posts to permit observers to look at marine life from the bottom through port holes in the sloping sides of the depressed central portion, thus affording views from all angles of giant fish and ocean mammals as they are found in natural surroundings.

Connected with the rectangular tank by a flume is a circular tank 75 ft. in diameter and 11 ft. deep. Steel frames as well as steel plate shells of the tanks are electrically welded. Maximum thickness of the walls is 2⅛ in., including 1¾ in. of Gunite reinforced with wire mesh. Steel window frames are welded in place, and the glass is sealed with rubber gaskets. For reasons of visibility, Tuf-flex glass ⅝ in. thick was chosen at slightly higher cost than 1-in. plate glass, as the thinner glass offered equal safety factor.

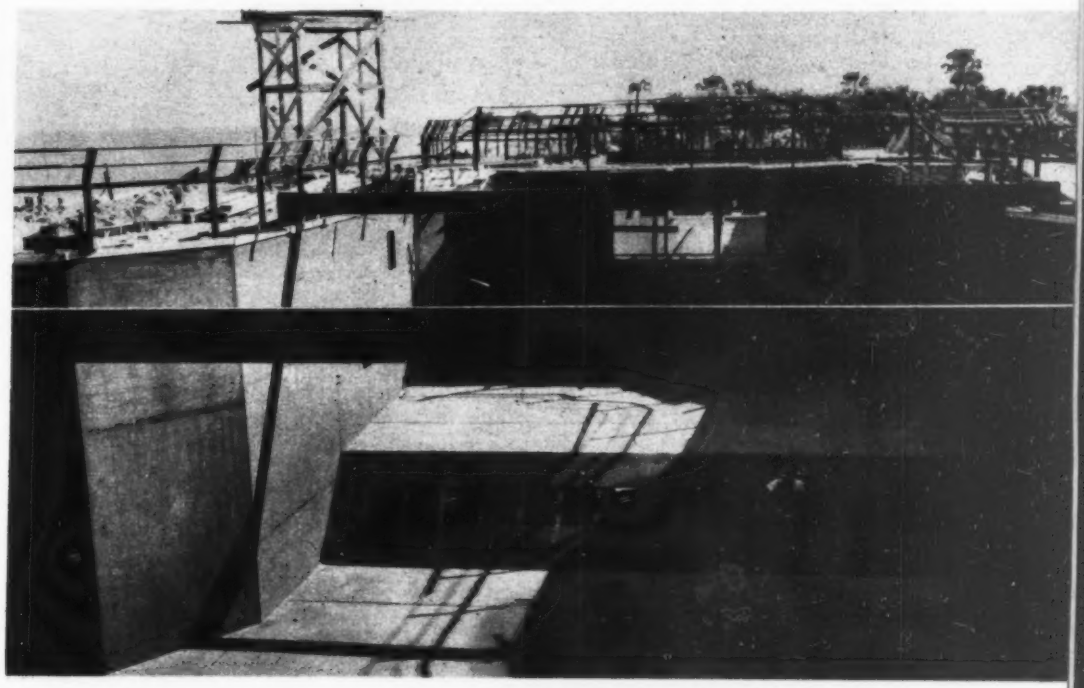
M. F. Hasbrouck, president, Hasbrouck Co., New York City, was responsible for design and construction. The entire cost is estimated to be about $500,000. Ingalls Iron Works, Birmingham, Ala., supplied the steel.

WINDOW FRAME of port hole is welded to steel plate wall, making watertight fused joint around frame.



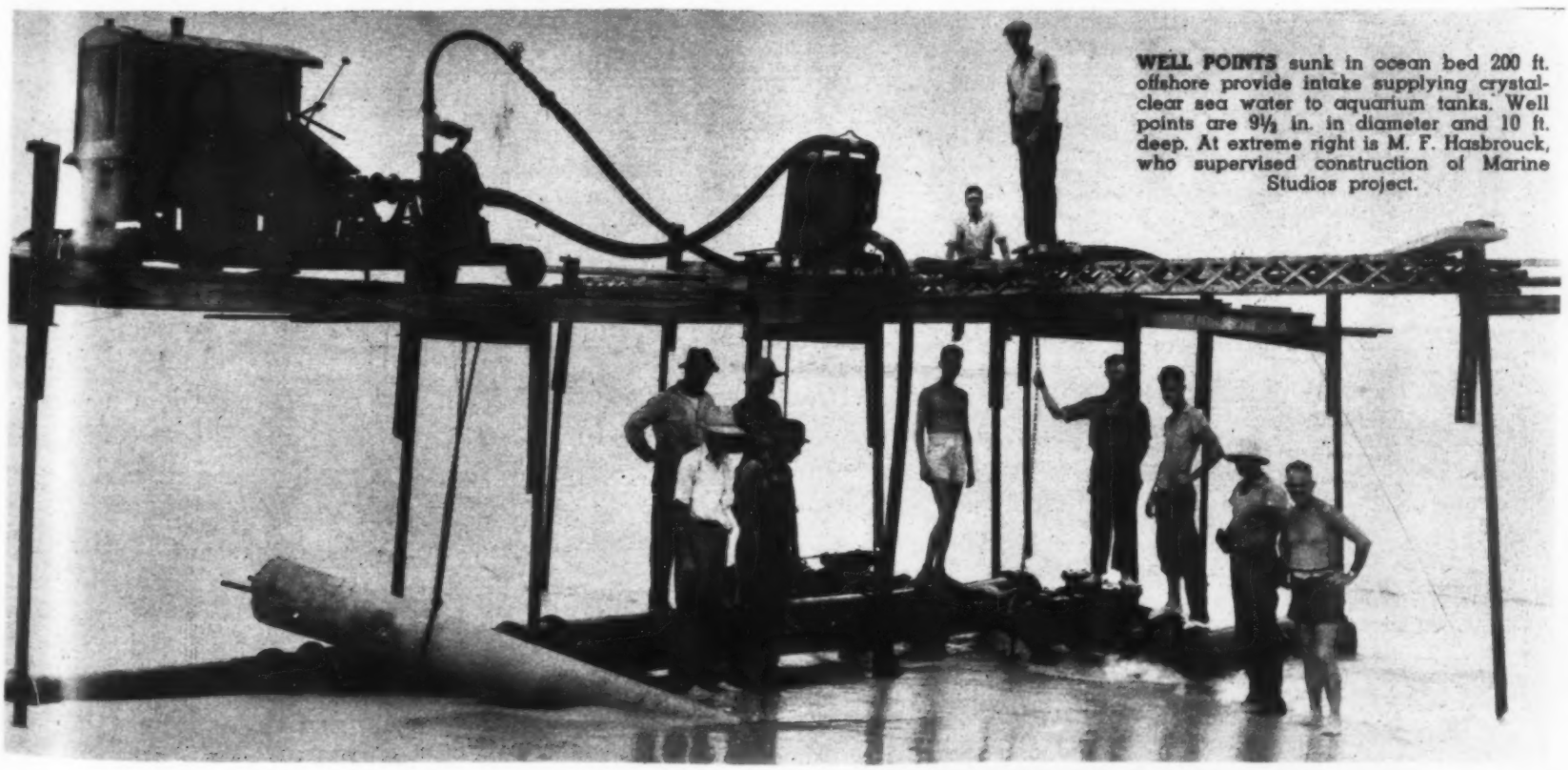
PORT HOLE (left) is glazed with 5/8-in. plate of Tuf-flex glass to provide good visibility for observing and photographing fish.

STEEL PLATE for construction of rectangular tank swings into place on boom of Northwest crane.



DEPRESSED CENTRAL PORTION of electrically welded angular tank has sloping side walls fitted with port holes for bottom view of marine life in aquarium.

WELDED STRUCTURAL FRAME (left) supports walls and floors of steel tanks. Ends of angular tank are raised to permit observation of central depressed portion through bottom-view ports in sloping walls. Workmen are setting frame for one of these windows.



WELL POINTS sunk in ocean bed 200 ft. offshore provide intake supplying crystal-clear sea water to aquarium tanks. Well points are 9½ in. in diameter and 10 ft. deep. At extreme right is M. F. Hasbrouck, who supervised construction of Marine Studios project.

ON PIPE-LINE GRADE between adjacent portals of two tunnels, contractors locate portion of construction plant for driving headings and lining full length of two bores. Remainder of plant is at top of canyon, connected with pipe-line grade by inclined railway in background.

Tight Work In Small Tunnels

Tests Contractors' Ingenuity

TOUGH, TENACIOUS ROCK stratified in irregular and unpredictable formations of varying hardness and deadness presented a baffling blasting problem to Ligon & Ligon, Baltimore, Md., in driving two small-bore tunnels, aggregating 4,600 ft. in length, for the pipe line of the Pinnacles Hydro-Electric Development, a municipal project of the City of Danville, Va. Using high-strength explosives to pull 5-ft. rounds in the small tunnels (cut 8 in. larger than the 70-in. finished diameter) the contractors after many experiments found it necessary to employ heavy charges of dynamite to make steady progress of three shots per day in each of the headings driven from the four portals. After driving and trimming the tunnels, the construction organization faced another difficult problem in placing 4-in. minimum concrete lining in the 70-in finished bores. Ingenious equipment was designed to deliver mixed batches to a pneumatic placer which shot the concrete through 5-in. pipe line into all-welded collapsible steel forms.

Scope of Contract — Under a contract valued at $864,000, Ligon & Ligon drove and lined the two tunnels, built the grade for 5,330 ft. of wood stave pipe line and constructed a concrete arch dam 130 ft. high containing 21,500 cu. yd. of concrete. Construction of features other than the tunnels will be described in subsequent articles. Total cost of the development will be $3,405,000, financed by PWA 45 per cent grant and a municipal bond issue sold privately at a premium. Inacessibility of the project, located in the Dan River canyon of the Blue Ridge more than 80 mi. by road from Danville and 23 mi. from the nearest railroad, added to the difficulties of the contractors.

An unusually high hydrostatic head sets this project apart from other hydro-electric developments in the East. Tailwater at the power house is 703 ft. below spillway crest at the dam. Three 3,750-kva. vertical impulse turbine-generator units will generate power at 4,000 v., to be stepped up to 66,000 v. for transmission over a 62-mi. line to the city. To control the runoff from the small watershed of the Dan River, a concrete arch storage dam 140 ft. high is being constructed upstream from the diversion dam, completed as part of the Ligon & Ligon contract.

Tunnel Plant — Facing portals of the two tunnels are separated by 600 ft. of pipe-line grade excavated in the side of the canyon. On this intervening bench, near the portal of the south tunnel, the contractors installed a 38-deg. 15-min. incline 875 ft. long to lower materials and workmen from the canyon's edge. A 26-hp. steam

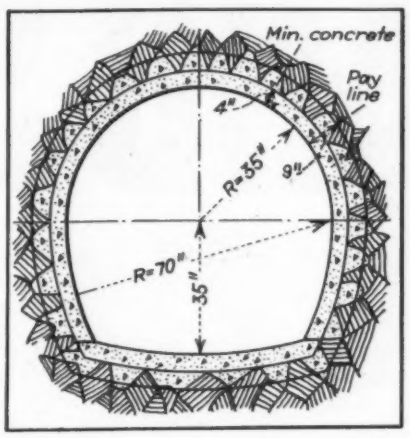
LONG WAY DOWN from hoist house at top of incline to bottom of 875-ft. cable railway erected on 38-deg. 15-min. slope. Car makes trip up in 2 min. 45 sec. and trip down in 1 min. 38 sec. Chute at upper right can be lowered to deliver sand from overhead wheelbarrow tipple into cable car.

CABLE CAR (right), on inclined railway lowers sand, cement and workmen from top of canyon to pipe-line grade. Two pipes at right of incline deliver stone and water by gravity from upper levels. Third pipe furnishes compressed air to receiver from compressor station at top of 875-ft. incline.

hoist engine at the upper end of the incline operated a cable car on the steep track. Sand and cement for concrete were lowered by the incline, but crushed rock was dropped through 6-in. pipe from bins erected by the contractors at the top of the precipitous slope.

A compressor station comprising a battery of three Schramm portable gasoline 315-c.f.m. machines was set up in a shed on the edge of the plateau at the top of the incline. With an oil change every 50 hr., these compressors ran continuously (except Sundays) for 9 months without interruption, A 4-in. pipe delivered air to a receiver on the pipe line grade, whence it was piped into the middle headings by 3-in. line. From the same compressor battery, the contractors ran a line to the south portal of the south tunnel, a distance of ½ mi. For the north heading of the north tunnel, a Schramm 420-c.f.m. gasoline compressor was moved to the crest of the ridge above the tunnel, and 800 or 900 ft. of line was run from the machine to the north portal.

Tunneling Schedule — Lengths of the two tunnels are equal, 2,313 lin. ft. each. Middle headings were started at the adjacent portals within two days of each other near the end of April, 1937. No additional heading was started until July 9, when the contractor opened the south heading of the south tunnel, nearest the penstock and power house. Three headings were worked from this date to Sept. 13, when the south tunnel holed through, and the miners started the north heading of the north tunnel. This bore holed through Oct. 13.



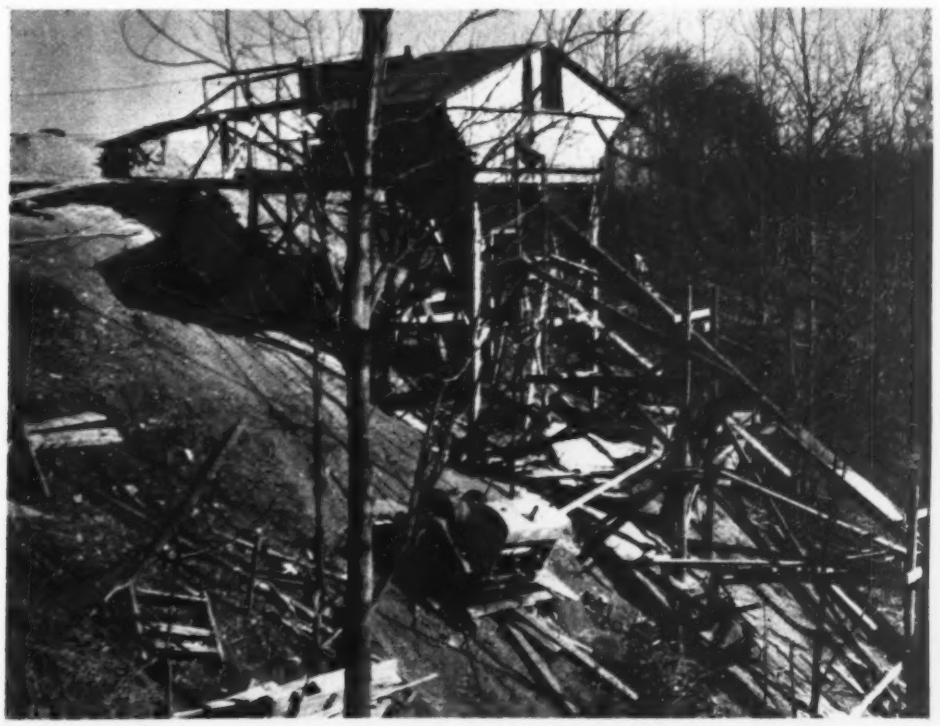
MINIMUM 4-IN. THICKNESS of lining requires use of small pipe to place concrete.

Ventilation for the two middle headings was provided by a 900 c.f.m. blower, capable of clearing 20 lin. ft. of tunnel per minute. This blower delivered air to each of the two headings through 6-in. metal pipe. For each of the other headings, driven one at a time, the contractors used a second blower of equal capacity delivering air through flexible canvas ventilating tube.

Driving Progress — Rock encountered in driving the tunnels consisted almost entirely of hard mica schist and gneiss. Abrasive quality of the rock took the gage off the drill bits, and the dead character of the formations required that the rock be burned out, rather than blown out, with large quantities of dynamite.

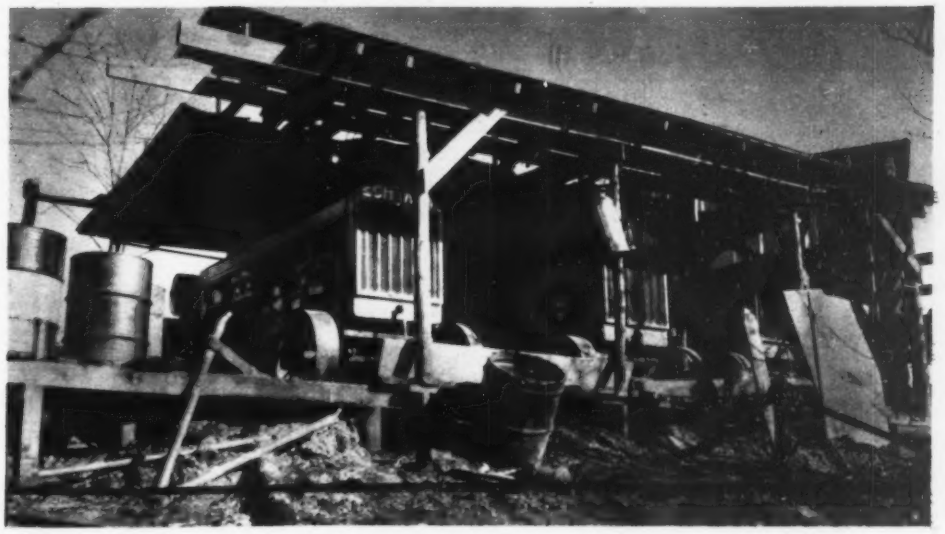
Two Ingersoll-Rand DA35 wet drifters mounted on columns in each heading drilled 22 holes per round, six cut holes 8 ft. long and the remaining holes 6 ft. long. Detachable bits (2½, 2⅛, 2 and 1⅞ in.) were used on 1¼-in. steel. To pull the face, 60 per cent special gelatin dynamite proved necessary. All holes were

MIXING PLANT (left), equipped with 14-cu.ft. mixer is built over narrow-gage track leading into tunnels.



STONE BINS at top of steep canyon slope feed crushed rock into 6-in. pipe line for gravity delivery to mixing plant on pipe-line grade.

SOUTH PORTAL of south tunnel offers some indication of small clearances available for lining tunnels to 70-in. finished diameter.



COMPRESSOR BATTERY made up of three 315-c.f.m. machines at top of incline supplies air to three headings.

TO BID AND STILL MA

Here a fast-moving Model LO, pulling a Gar Wood scraper, gains extra trips regularly and at the same time cuts finishing costs by spreading the load in even layers.

TO DETERMINE YOUR COST PER YARD CHECK THESE IMPORTANT POINTS AGAINST YOUR EQUIPMENT

- ☐ INITIAL COST
- ☐ WORKING SPEEDS
- ☐ UPKEEP COST
- ☐ TIME LOSSES FOR REPAIRS
- ☐ STARTING TIME
- ☐ COST OF FUEL PER GALLON
- ☐ COST OF LUBRICATING OIL
- ☐ WORKING LIFE
- ☐ TRADE-IN VALUE

If you use Allis-Chalmers equipment you'll find your final cost per yard low enough to consistently win job awards and still make a good profit.

ALLIS-C
TRACTOR DIVI

KE PROFIT$

Can you make a profit if your bid gets the job? A-C users do. You can figure, as *they* do, on moving dirt at a lower cost per yard. You begin by having a lower equipment charge-off per yard. Here's why: A-C tractors are designed to eliminate extra, pay-robbing deadweight, consequently you get more power per pound of weight and pay less per horsepower for it. Next, your operating costs are lower per yard because A-C Controlled Ignition Oil engines deliver a smooth flow of power that eliminates destructive engine pounding and reduces the expense and time loss of repair work. Fuel and lubricating costs are lower, too . . . no starting motor expense . . . you use standard engine lubricating oils, save 20 cents or more per gallon; burn any clean Diesel fuel or furnace oil, at savings up to 3c per gallon. Finally, your cost per yard is lower because you get more done with the ***Faster Power*** of Allis-Chalmers tractors. They start instantly in all weather and go right to work. You have plenty of reserve power for loading and quick grade climbing; ***Faster Power*** for gaining extra trips.

You can't make profits with idle machinery. Allis-Chalmers equipment moves dirt profitably—at figures that enable you to get jobs.

SEE YOUR ALLIS-CHALMERS DEALER!

Two SO's and an LO pulling Continental scrapers in a railway cut. Tough material, but the Continentals load fast, ramble to the fill in a hurry because SO tractors "shift on the go" like a truck and travel at higher speeds.

Here a New York contractor saves small shovel costs, loads 120 trucks of 3½-yard capacity in an 8-hour shift with a Model WM tractor and Hough Loader.

KO and Baker bulldozer cutting costs by moving rock, ordinarily a job for shovel and trucks.

S-CHALMERS

IVISION—MILWAUKEE, U. S. A.

Controlled Ignition
OIL TRACTORS

PINNACLES HYDRO-ELECTRIC PROJECT is constructed under direction of (left to right) P. G. LIGON, president, Ligon & Ligon, contractors, Baltimore; W. F. UHL, vice-president, Chas. T. Main, Inc., consulting engineers, Boston; J. J. DOWNEY, field engineer for Danville Electrical Department; and R. A. MONCRIEFF resident member of consulting firm, Danville.

IN CHARGE of field operations on Pinnacles Project is D. J. SHEA, resident engineer for Danville, Va.

tamped with Heitzman safety blasting plugs, and the tunnel driving was completed without the failure of a single hole. Each round was fired with instantaneous detonators and three delays in the following order: six cut holes, instantaneous; four relievers, first delay; eight rim holes, second delay; four bottom holes, third delay. This round was adopted as standard for normal rock conditions after it had proved the most efficient and satisfactory of various experimental rounds tested in the tunnels.

In starting the tunnels, the contractors employed four 6-hr. shifts, but the crews found it impossible to muck, drill and shoot four full rounds per day in each heading. A change then was made to three 8-hr. shifts, each crew being paid for 8 hr. even though it completed the round in a shorter period, providing additional time to clear the heading of gases before the next crew entered to start mucking and drilling. When working 6-hr. shifts, the average progress per shift was 4.6 ft. For the 8-hr. shifts, the average progress was 5.2 ft. The overall average for the entire job was 4.97 ft. per shift.

Automatic power feed for the drifter drills was given a trial in the tunnels, but because of the uneven character of the rock, with its variations in hardness, the negro drill runners from Baltimore were able to make better progress with hand feeds. During the early stages of the work, when operating 6-hr. shifts, the contractors supplied gas masks to the crews in an effort to get the miners into the cleared heading more quickly.

Close working quarters in the small tunnels made special hauling equipment necessary. Muck was hauled out of the tunnels by mules in demountable mine cars made in the Ligon & Ligon shop in Baltimore. The cars had wooden bottoms and removable steel sides and ends which could be taken off in the tunnel, permitting the cars to be knocked down and set on edge against the tunnel walls while loaded cars passed. Each round pulled about 9 yd. of rock, which was loaded by hand and hauled out of the tunnels in two strings of 1-yd. cars.

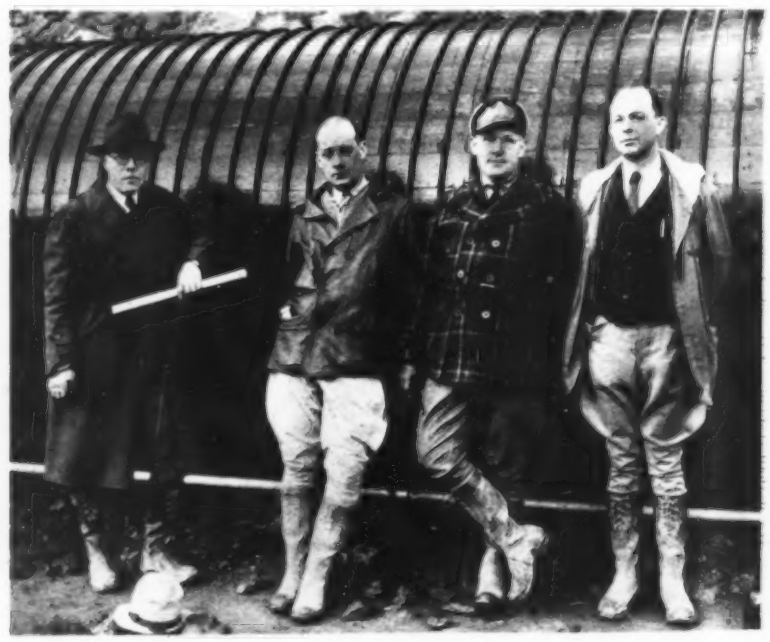
Because the contractors elected to excavate the tunnels to minimum clearance, considerable trimming was necessary. For this trimming the tunnel crews used five wet jackhammers and one stoper.

Concrete Lining — Tunnel lining concrete was mixed in a plant equipped with a 14S mixer at the foot of the incline. To allow additional headroom for concreting the arch, invert concrete was placed last. A special traveling high line, coupled to the pneumatic placer in the tunnel, was designed to facilitate delivery of mixed concrete to the hopper of the placing unit.

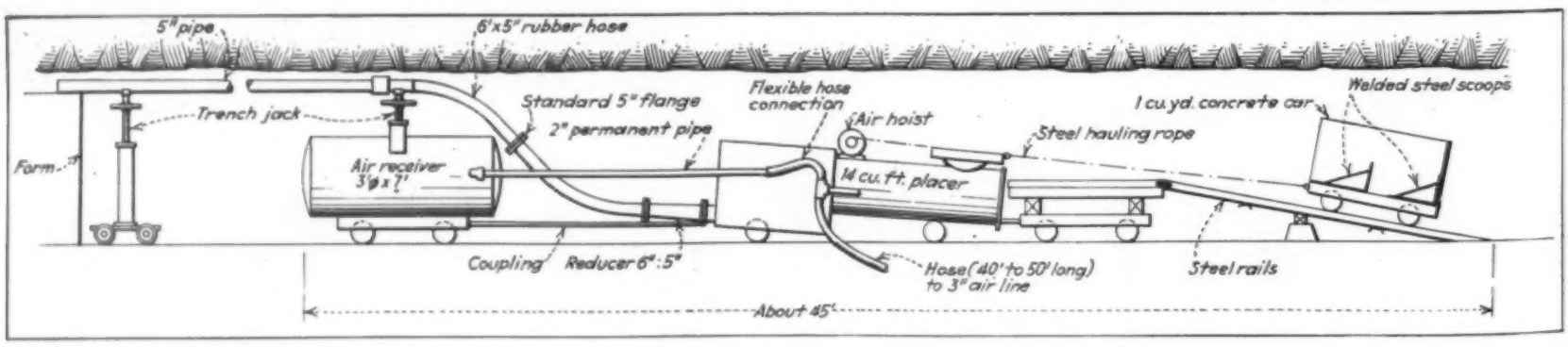
Mine cars used previously for hauling muck served again in handling concrete. For the latter service, the wooden bottoms were lined with steel and the cars were equipped with welded steel slip scoops, each scoop holding ½ cu. yd. of concrete. A Plymouth gasoline locomotive pushed loaded cars from the mixing plant into the tunnel, passing knocked-down empty cars laid against the tunnel wall. The empty cars were reassembled on the track for pulling out on the return trip. Six cars, operated two to a train, supplied the Ransome placing gun.

To pull the cars up onto the high line in the tunnel, the contractors mounted an air hoist on the concrete gun. A hauling rope from the hoist pulled a loaded

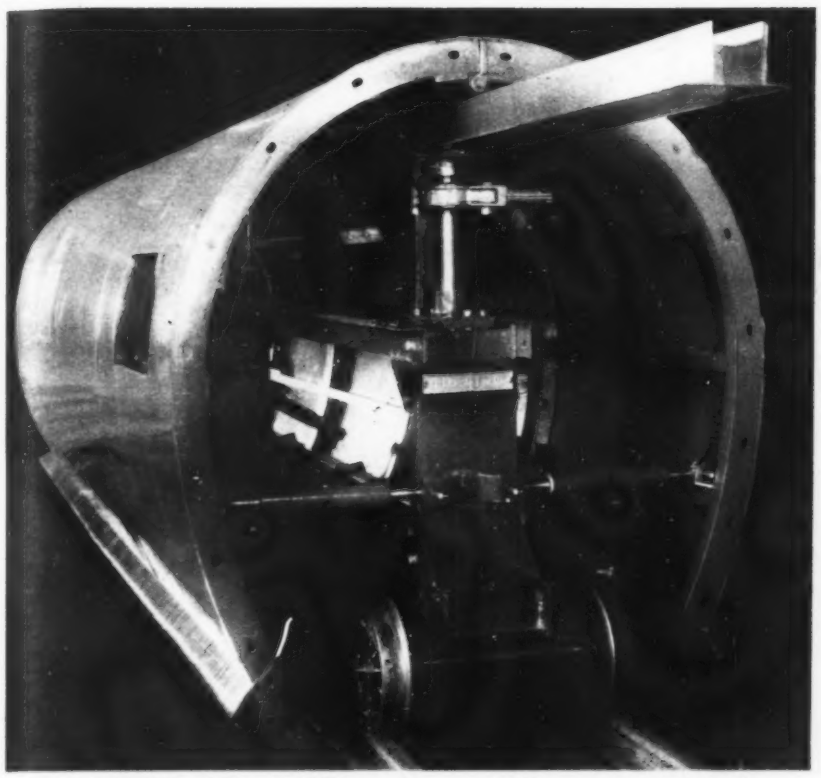
DIRECTING CONSTRUCTION of two concrete arch dams is DEWEY T. HOGUE, superintendent for Ligon & Ligon and Sammons - Robertson Co., Inc.



LENDING THEIR SUPPORT to wood stave pipe line are four men responsible for supervising construction work on project (left to right): H. H. BURTON, conservation engineer for PWA; J. S. WILLIAMS, general superintendent for Ligon & Ligon, contractors; J. J. DOWNEY, field engineer, and C. H. HYLTON, assistant resident engineer, Danville Electrical Department.



CONCRETE PLACING RIG utilizes air hoist mounted on gun to handle 1-cu.yd cars and unload scoops. Trench jacks support 30 ft. of 5-in. pipe during moves.



TRAVELING STEEL FORMS, made up of 10-ft. sections assembled into units 30 or 40 ft. long, are designed for collapsing and moving on rolling carriage.

car up the incline to the level track of the high line, carried on a converted mine car as shown in the accompanying sketch. When in this position, the steel front panel of the car was removed, and the hauling rope was hooked to a bridle at the front of the forward scoop. As the scoop was drawn out of the car, some of the concrete dropped from the scoop into the hopper of the concrete placer. The bottom of the scoop was cut out in a circular arc, fitting the opening in the hopper, to facilitate this unloading. When the scoop was in position over the opening, the hauling line was changed to a hook at the top of the back of the scoop, and the scoop was tipped forward to complete the unloading.

Because of the small clearance afforded by the 4-in. minimum thickness of concrete lining, concrete was shot from the placer into the forms through 5-in. pipe instead of the usual 6-in. size. Even with this small pipe, it frequently was necessary to dig out additional rock to admit the pipe between the steel form and the roof. Threaded couplings were used on the pipe, instead of quick-acting couplings, to save space. Trench jacks providing about 15-in. vertical adjustment supported the pipe, and 6 ft. of rubber hose in the gooseneck gave flexibility for lowering the line when moving the placing rig. When following the normal procedure of placing concrete in 30-ft. lengths of forms, the concrete crews did not disconnect pipe sections between moves, as the trench jacks could carry 30 ft. of pipe between set-ups.

For lining the two tunnels, the contractors had 120 ft. of Mayo all-welded traveling steel forms, distributed 60 ft. in each tunnel. At the start, the concrete crews filled 60 ft. of forms in one operation, it being the practice at that time to line 60 ft. in one tunnel and 30 ft. in the second tunnel every 24 hr. Occasional plugs in the 60-ft. lengths of 5-in. pipe caused the superintendent to divide the forms into 30-ft. units, which remained standard for most of the lining work. As the forms filled with concrete, the air hoist on the placer was used to pull the entire placing rig back about 5 ft. at a move. To aid consolidation of the concrete as it was being placed, workmen rapped the ribs of the steel forms with 8-lb. hammers.

For three 100-ft.-radius curves in the south tunnel the contractors built special wooden forms in 5-ft. sections hinged at the crown. In order to get the pipe into the forms, it was necessary to concrete the curves in 10-ft. units. While lining these curves in the south tunnel, the superintendent transferred 10-ft. sections of steel forms to the north tunnel to lengthen the two 30-ft. units to 40 ft. each. The concrete placing rig filled the 40-ft. forms without difficulty.

Tunnel lining concrete was designed for a minimum compressive strength of 2,000 lb. per square inch at 28 days. An accompanying table gives the proportions of the mix. Coarse aggregate was crushed mica schist of 1½-in. maximum size. For fine aggregate, the contractors used crushed flint field stone, — a sharply abrasive sand which wore out the pipe line of the placing rig in the course of the job. Adding one bag of hydrated lime to each cubic yard facilitated placing by improving the workability of the concrete. Concrete was mixed 1 min. in the 14S mixer. Cylinder tests averaged about 3,000 lb. at 28 days.

Tunnel Concrete

PROPORTIONS PER CUBIC YARD

Cement	4.5 bags
Hydrated lime	1.0 bag
Dry sand	1,100 lb.
Dry stone	2,140 lb.
Water	39 gal.

Water is limited to 7⅓ gal. per bag of cement plus lime. Lime, weighing 62½ lb. per bag, is equivalent to 0.7 bag of cement.

Tunnel lining crews worked three 8-hr. shifts per day in each tunnel. Arch lining progress in the north tunnel averaged 50 ft. per day for 46 days, totaling 2,313 ft. Floor progress was 208 ft. per day for 11 days, a total of 2,288 ft., leaving 12½ ft. at each portal for a 70-in. steel thimble to which the wood stave pipe is coupled.

Arch concreting in the south tunnel took more time because of the curves and the necessity of leaving the forms on longer. The average progress was about 38 ft. per day for 61 days, in a total length of 2,313 ft. Floor progress was 254 ft. per day for 9 days, a total of 2,288 ft., with 70-in. steel thimbles at both ends of the tunnel.

Preliminary Cleaning — Prior to setting forms, workmen washed the sides of the tunnel with an air and water jet. Water at about 100-lb. pressure was taken from the water line in the tunnel and was jetted through a 1-in. pipe into which a 1-in. air connection had been welded. Air at 90-lb. pressure entered the stream through this connection. The jet gave excellent scouring action at low cost.

Steel Liners — Only two soft spots were encountered in the tunnels. The contractors used steel plates to line these sections, installing 70 ft. in the north tunnel and 30 ft. in the south. Water was struck at only one point, in the south tunnel, and an air pump at this location was able to take care of the flow.

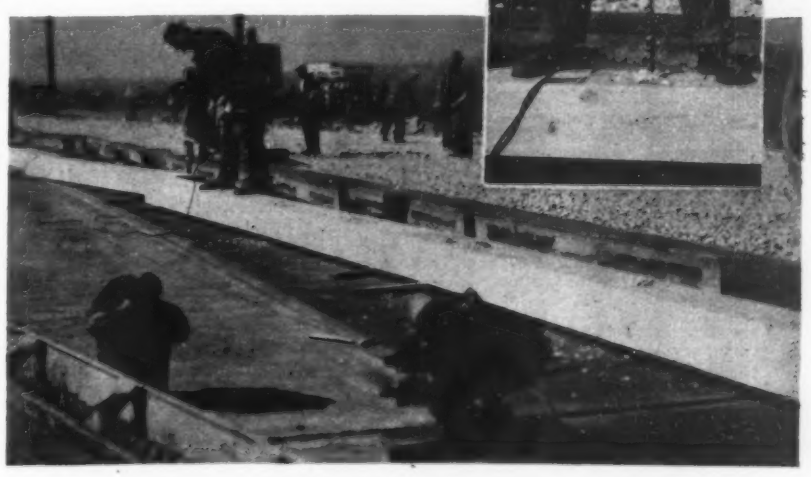
Administration — The Pinnacles Hydro-Electric Development is being constructed by the Electrical Department of the City of Danville, Va., with the aid and advice of Charles T. Main, Inc., Boston, consulting engineers. E. C. Brantly is manager of the Electrical Department, and R. A. Moncrieff is resident member of the consulting firm at Danville. Operations on the project are directed for the city by D. J. Shea, resident engineer; C. Howard Hylton, assistant resident engineer; and J. J. Downey, field engineer. The interests of PWA are represented by J. R. A. Hobson, Jr., project engineer, Danville.

For the contractors, Ligon & Ligon, of Baltimore, J. S. Williams is general superintendent in charge of the work.

Portable Generator Set

Feeds Power to Electric Drill

A PORTABLE gasoline-powered 600-watt Homelite generator supplied 110-volt current to a Black and Decker electric drill which sank bolt holes in 10x12-in. fir timbers for temporary curb on a section of the West Side improvement along the Hudson River, New York City, paved by Good Roads Engineering & Contracting Co., Wantagh, Long Island. The portable generator rests on the pavement in the foreground (*below*), while the drill operates in the background and in inset (*at right*).



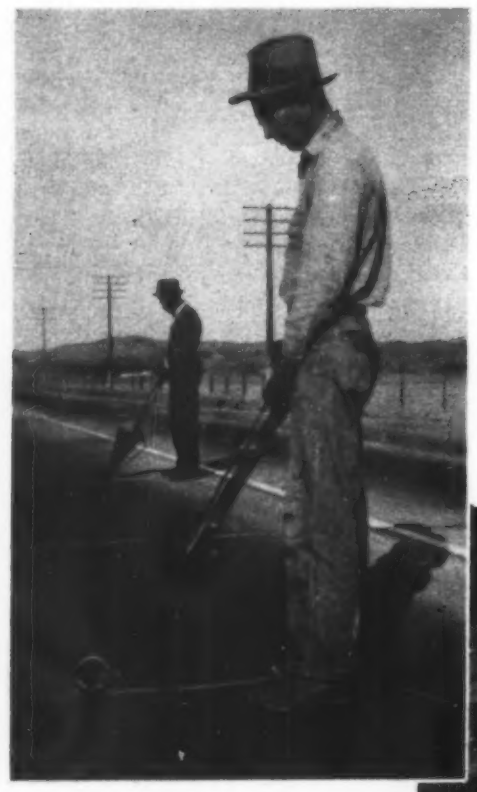
How They Did It

CONSTRUCTION DETAILS

For Superintendents and Foremen

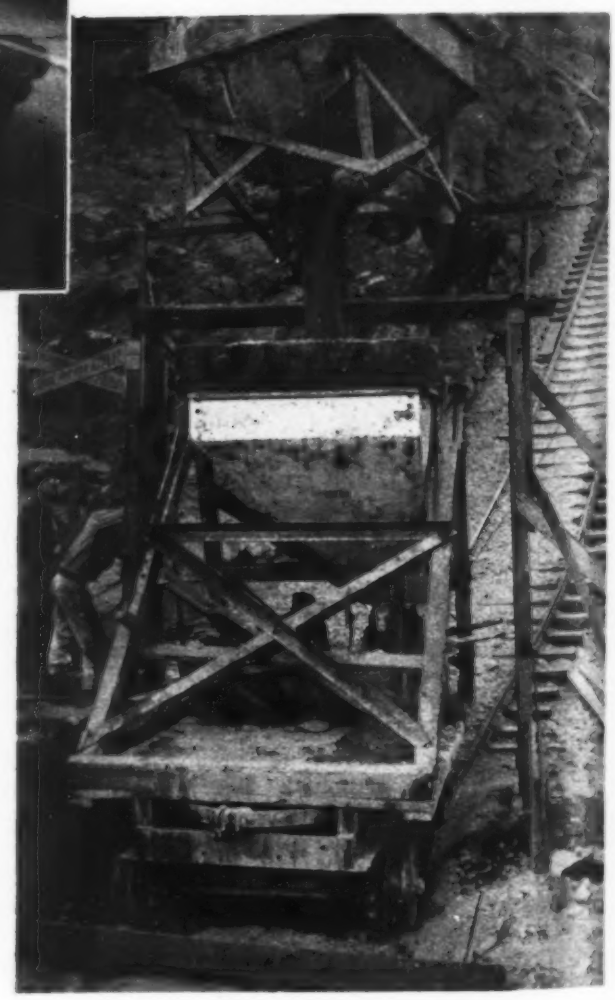
PUMP ON SUBGRADE transfers water from tank truck (not visible) to storage tank on traveling mixing plant for wetting soil particles and causing complete dispersion of bituminous material throughout mixture on Kentucky bituminous soil stabilization project built by Ralph E. Mills Co., Frankfort, Ky., using travel plant belonging to S. G. Hayes, of Chicago. Portable pump mounted on sled base is drawn ahead by tank truck as plant moves forward.

DUMPING LOADED PAIL of brick or mortar on building work is accomplished by short length of rope fastened to underside, at center, and ending at upper end in snap hook attached to eye of S, or chain, hook on end of lowering rope which engages bail of pail. As pail reaches ground bail unhooks itself and pull on main rope overturns bucket. — Photo from ANDREW VENA, Carl J. Anderson Co., building contractor, New York, N. Y.

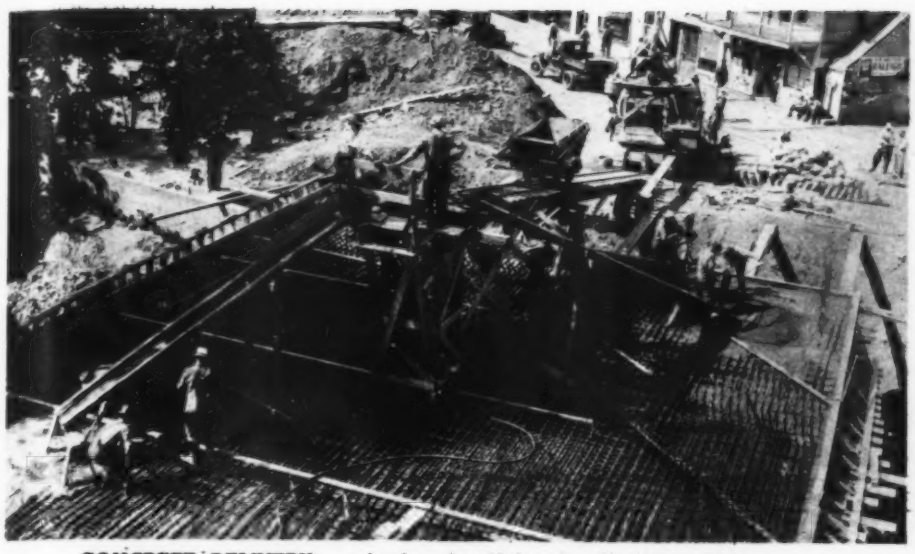


"SCOOTER" POT (left) for pouring bituminous joint filler in concrete pavement rides on small wheel offset 1½ in. to carry weight of pot and relieve operator of back strain by allowing him to stand erect. Device was designed by Ernest Wasson, maintenance foreman at Los Alamos for the California Division of Highways.

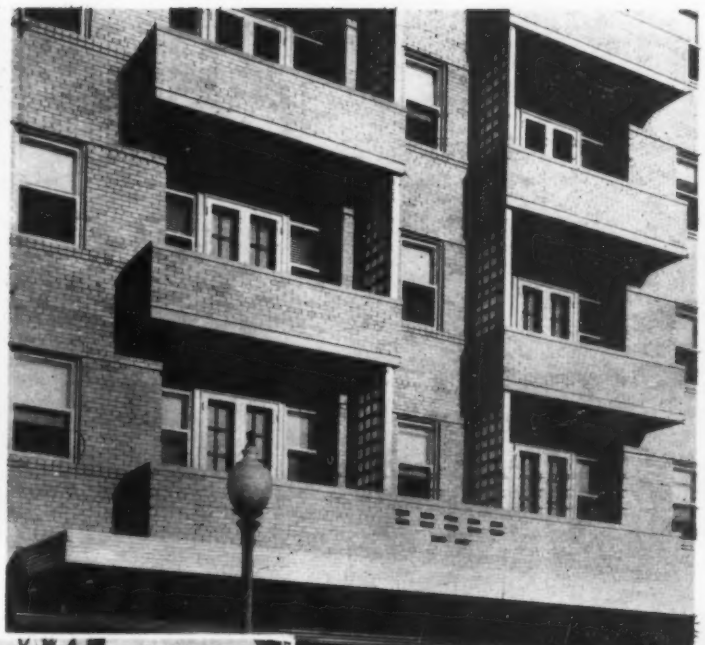
SWINGING HOPPER (below) of 2 yd. capacity, mounted on four-wheel car, carries concrete up inclined railway track to surge chambers of intake at Parker dam on Colorado River aqueduct in California. Car hopper is filled with concrete by second hopper handled from mixer by crawler mounted crane. Work is being done by Winston Bros. and William C. Crowell.



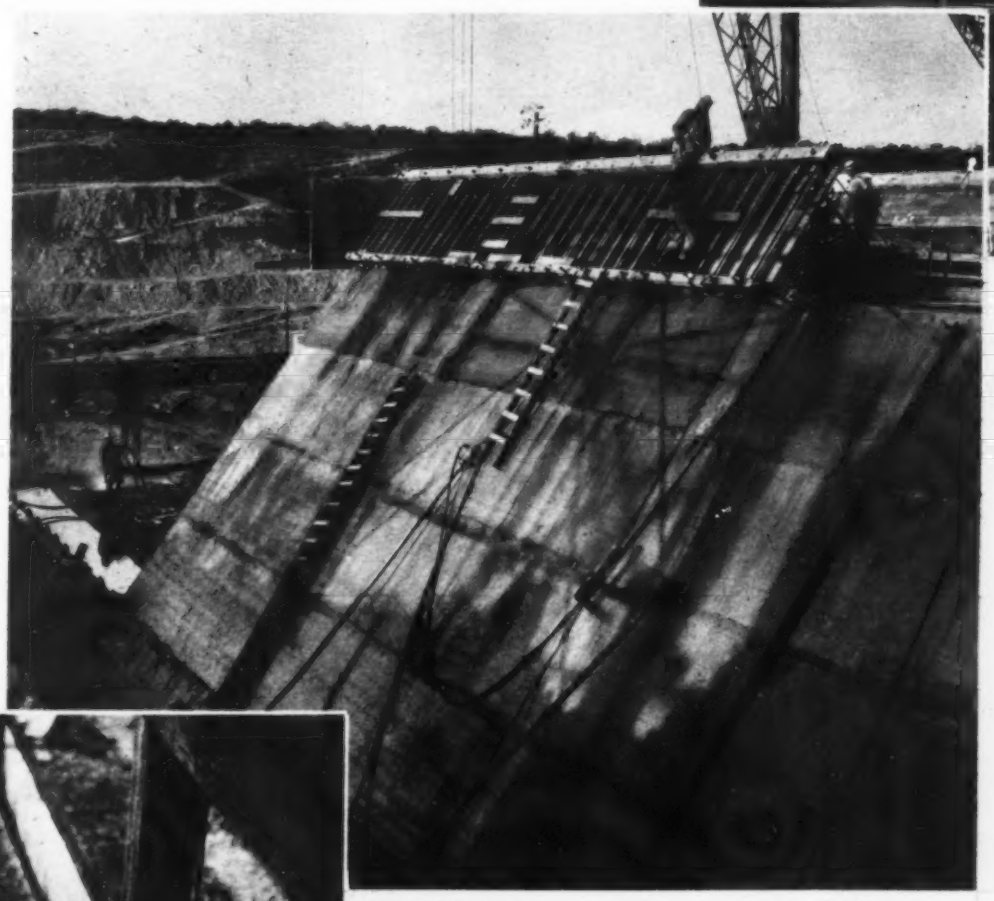
DOUBLE SURFACE TREATMENT along edges of Virginia bituminous pavement (while applying single treatment to remainder of surface) strengthens weakest part of pavement at small cost without any adverse effect on riding qualities. Use of very coarse aggregate in edges helps to prevent destruction of pavement by frost action. — Photo from J. J. FORRER, assistant engineer in charge of maintenance, Virginia Department of Highways, Richmond, Va.



CONCRETE DELIVERY on bridge for Nebraska Highway Department is accomplished by radial chutes from central hopper fed by car operating on inclined track from mixer.



"PRIVACY SCREENS" of Insulux glass block separate outdoor balcony porches of new apartment building at 2407 Fifteenth St., N.W., in Washington, D. C. Translucent, but not transparent, glass block panels provide privacy for each occupant without shutting off light. — Photo, Owens-Illinois Glass Co.



WOOD FORMS (right) are bolted in place for a new concrete pouring lift at Marshall Ford dam, being built for U. S. Bureau of Reclamation by Brown & Root, Inc., and McKenzie Construction Co., of Austin, Tex., under $5,781,000 contract, as flood control unit of Colorado River project in Texas. Dam will have maximum height of 190 ft. and will contain nearly 1,000,000 cu.yd. of concrete.

SUPPORT (left) for overhang of concrete bridge floor is provided by wooden beam at ends of handrail post brackets on farm-to-market bridges in Missouri. Since load is light, beam is supported on bolt head resting on outstanding leg of angle used in bracket. — Photo from D. C. WOLFE, of Sverdrup & Parcel, consulting engineers, St. Louis, Mo.

DIAMOND-DRILLED HOLE, (right) 2¾ in. in diameter and 500 ft. deep, carries lead-covered, steel-armored General Electric power cable to underground substation for 6,000-ft. tunnel at Lava Gap gold mine in California, saving $4,000 in cost of carrying power cable through entire tunnel length.

WANTED — Photos of Details

The Editor of Construction Methods and Equipment wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

AQUEDUCT BUILDERS

CAUGHT BY THE CAMERA of CONSTRUCTION *Methods and Equipment's* representative, here are a few of the engineers and contractors who are constructing the 242-mi. main line of the Colorado River aqueduct in California. Under direction of F. E. Weymouth, general manager, Metropolitan Water District of Southern California project, when completed, will carry a billion gallons of water daily from Parker diversion dam, on Colorado River, to Cajalco reservoir, near Riverside, from which distribution system will serve 13 cities in Los Angeles and Orange Counties.

FIELD ENGINEERS and surveyors who check line and grade on siphons and conduit at Mecca Pass include **(left to right)** T. N. WHITFORD, senior engineer; J. C. DYAS, chief of party; L. C. SMILEY; P. E. TOPE; and H. D. SHULER.

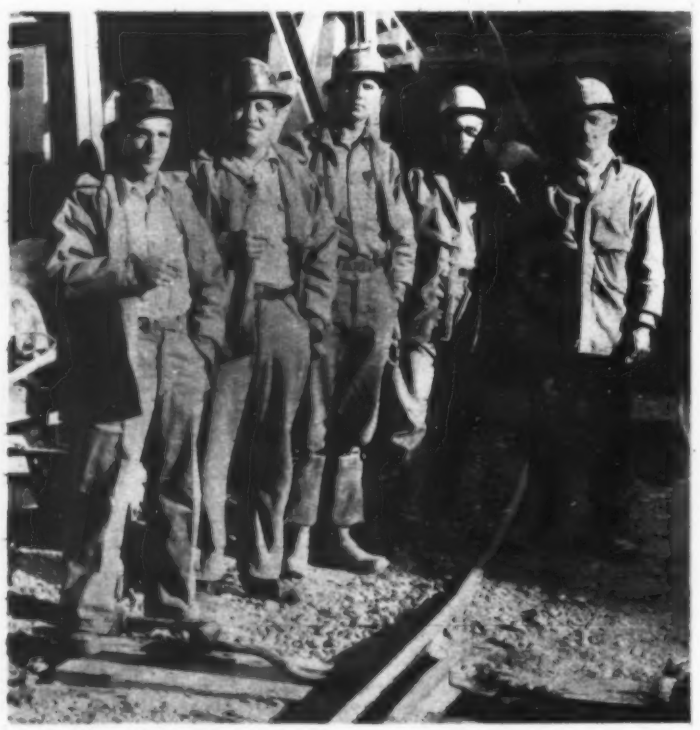
FROM FIELD OFFICE on Thompson-Starrett Co. siphon and conduit contract emerge T. N. WHITFORD, senior engineer, and D. C. WALKER, assistant district engineer, of Metropolitan Water District.

INSPECTION OF DIVISION I headquarters at Parker dam is made by **(left to right)** H. R. McBIRNEY, civil engineer of Canal Division, and W. H. NALDER, assistant chief engineer of design, from the U. S. Bureau of Reclamation's Denver office, who confer with G. E. ARCHIBALD, resident engineer, and W. E. WHITTIER, division engineer, of M. W. D.

THOMPSON-STARRETT CO., contractor, is represented at Mecca Pass siphon job by **(left to right)** JOHNNIE HIGH, concrete superintendent; L. A. McGILLIVARY, resident engineer; and O. KIRSTON, chief electrician. Johnnie High was superintendent of steel erection for Starrett Bros. & Eken on McGraw-Hill Building, New York City, home of "CONSTRUCTION Methods and Equipment."

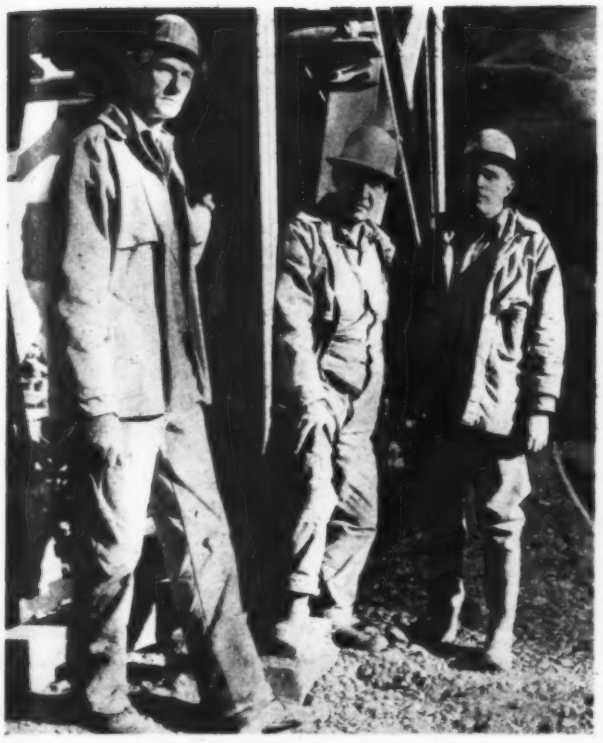
SUPERINTENDENT of electrical construction and maintenance for M. W. D. on San Jacinto tunnel is T. F. ROBERTSON.

POTRERO SHAFT of San Jacinto tunnel, tough job due to water inflow, is in charge of S. J. SHRODE, superintendent for M. W. D.



TUNNELERS at Lawrence adit of San Jacinto bore include **(left to right)** GENE SMITH, assistant engineer; HENRY C. BRUCE, office engineer; JACK G. FARMER, resident inspector; A. S. JOHNSON, assistant superintendent; and JAMES WISE inspector, all with M. W. D.

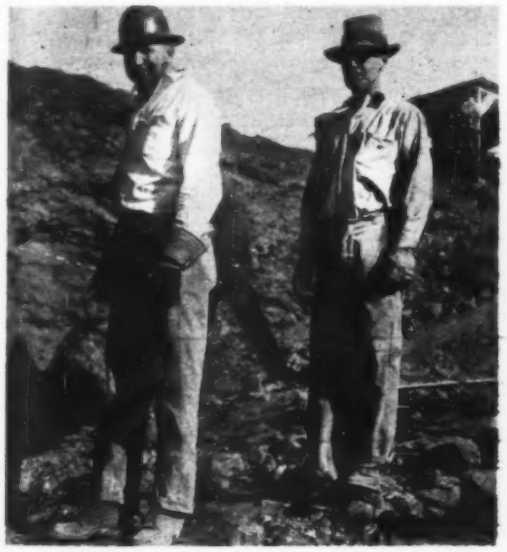
ON CAJALCO DAM general superintendent for Griffith Co., is FRANZ A. FOHL.



UP FOR AIR at Lawrence adit on San Jacinto tunnel are, **(left to right):** JOHN R. AUSTIN, superintendent; H. W. COVERT, in charge of pumps; A.S. JOHNSON, assistant superintendent, all with M. W. D.

INSPECTOR for M. W. D. at intake plant, L. PROSIN, confers with J. O. GILLISPIE, concrete foreman for Winston Bros. & William C. Crowell, contractors.

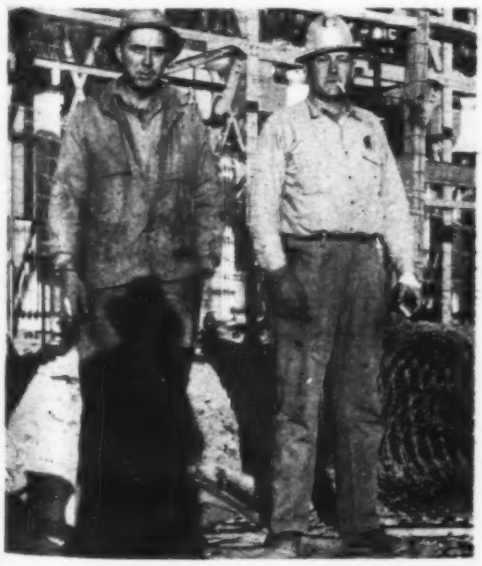
AT HAYFIELD PUMPING PLANT, C. F. STROEHECKER (left) superintendent, confers with L. E. DIXON, general manager for L. E. Dixon and Case Construction Co.



GENE WASH DAM is being built by J. F. Shea Co. for whom JOHN M. SAWYER (left) is superintendent. He is accompanied by R. I. CLARK, inspecting engineer for M. W. D.

GENERAL FOREMAN for J. F. Shea Co. at Gene Wash dam, is (left) A. T. SCHUNCK who discusses job progress with H. H. CUTLER, resident engineer for M. W. D.

INTAKE PUMP PLANT at Parker dam is a Winston Bros. & Crowell job on which J. C. McDONALD (left) is general foreman, and E. SNYDER, superintendent.



MASTER MECHANIC M. O. HANN and chief electrician PAUL G. HAUCKFELDT, both with M. W. D., solve many knotty problems at San Jacinto tunnel.

AT CAJALCO DAM Metropolitan Water District is represented by **(left to right)** N. F. CROSSLEY, district engineer; R. B. WARD, resident engineer; and L. W. IRWIN, office engineer.

M. HJALMARSON is superintendent for Broderick & Gordon, contractors, on outlet tunnel for Cajalco dam.

BARTON COOMBS is general foreman for L. E. Dixon Co., contractor, at Eagle Mountain pump lift.

FLEXIBLE ASPHALT MATTRESS. reinforced with wire mesh, is cast on barge and launched in continuous sheet to protect river bank from scour by current. Average mattress is about 500 ft. long.

Asphalt Mattress

For Protecting River Banks, Is Cast in One Continuous Unit From Barge

By LIEUT. COL. W. F. TOMKINS
District Engineer, U. S. Army, New Orleans, La.

(From a paper presented at the Eleventh National Asphalt Conference, Memphis, Tenn.)

IN DEVELOPING flood control and river and harbor construction methods, the U. S. Engineer Department has found asphalt particularly suited for several new uses. Two uses in particular, namely, bank revetment and paving for the protection of river banks from current action and levee paving for the protection of earth levees from wave action, have been fully developed. Promising results have also been obtained in connection with jetty construction, although this use of asphalt is still in the development stage.

The asphalt mattress used for bank protection consists of a continuous sheet of asphalt mixture, somewhat softer than that used in street paving, reinforced with galvanized welded wire fabric and steel cables, to take the stresses which occur during the sinking operation. Asphalt wave wash protection consists of a non-reinforced paving spread and tamped by hand. The Engineer Department has also used asphalt in jetty construction to cap existing jetties, to provide foundation mats and to rebuild an entire jetty.

The asphalt mattress for bank protection on the lower Mississippi River, which has now been fully developed, is an outstanding achievement in the use of asphalt for river and harbor works. I shall therefore discuss this work in some detail.

In 1933 Col. J. N. Hodges, District Engineer of the Second New Orleans District, undertook to develop a plant to make and sink this mattress. The plant is a direct evolution from the articulated concrete mattress plant.

There are many places along the Mississippi River where, unless it is protected, the current scours the bank and destroys much valuable land. To prevent this action, a complete covering of the bank is required. In the past, willow mats have been used for this purpose and in the Vicksburg and Memphis Districts the articulated concrete mat, which succeeded the willow mat, is still in use. Bank protection, to be effective, must reach from one end of the front under attack to the other and must extend well out from the shore, generally to the deepest water. A successful mat must possess durability to resist the attack of the elements, must have strength and flexibility to enable it to accommodate itself to a changing river bottom, and must be financially practicable. The placing of such mats is not only a difficult, but also a very expensive task. In order for the work to be economically feasible at all, it has long been recognized that mattresses must be constructed of cheap, locally available materials.

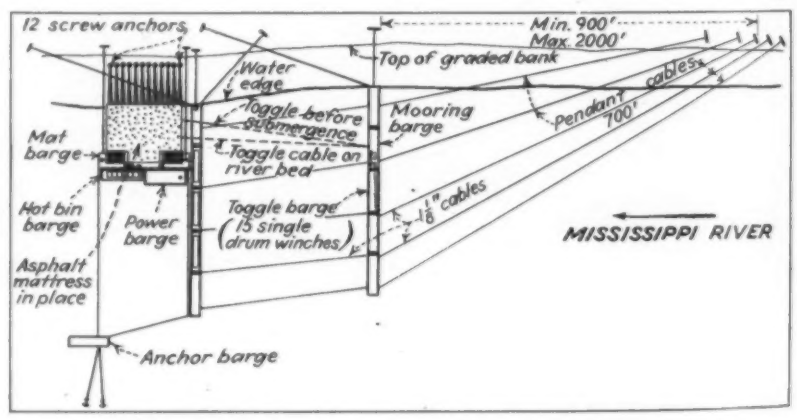
The conception of designing asphalt mixes with cheap local materials was considered radical at the time this development was undertaken, but has proved entirely successful. It was found, however, that an excellent mix could be made, using the sands which occur along the river. Search for a filler led to the selection of loess, the fine wind-blown deposit which caps the river bluffs from near Baton Rouge, La., to Cairo, Ill.

Even when everything is done to keep costs to a minimum, the asphalt mattress is still an expensive undertaking, costing approximately 15¢ per square foot, or $100 per linear foot of bank along the lower Mississippi River, where depths are great, frequently exceeding 100 ft. Therefore, the protection of the bank by revetment is economically justifiable only where it is impracticable to set the levee back or where land values are such as to justify the great expenditure.

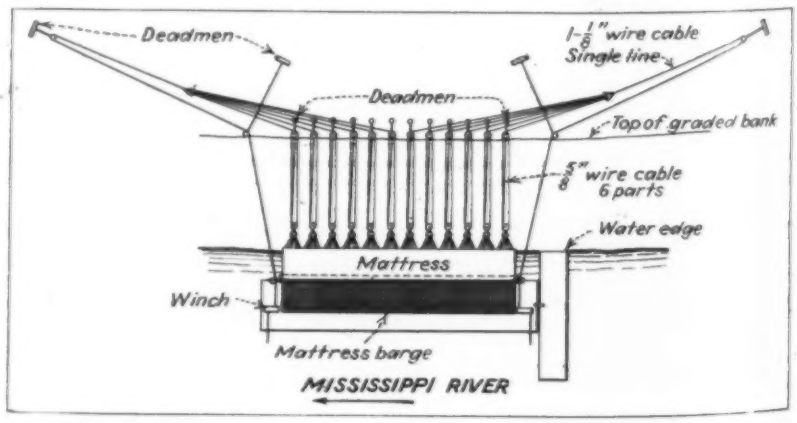
Assuming that it has been decided to revet a given reach of the river, a careful survey is first made. Soundings are made at the rate of one to every 400 sq. ft. of river bottom, or approximately 7,000 accurate soundings per mile. From these soundings profiles are plotted and a general layout of the bank preparation is then made. The layout provides a bank line as nearly parallel to the current as practicable, with a slope of from 1:3 to 1:5.

The bank then is graded to conform to this layout by means of a bottomless scraper bucket handled by a dragline machine mounted on a barge between two stringouts. At present this grading is carried to about 40 ft. below the level of the water. After rough grading with the bucket the bank is dragged with a heavy drag, which eliminates minor irregularities not removed by the bucket. A diver is used in connection with this operation to remove snags and stumps.

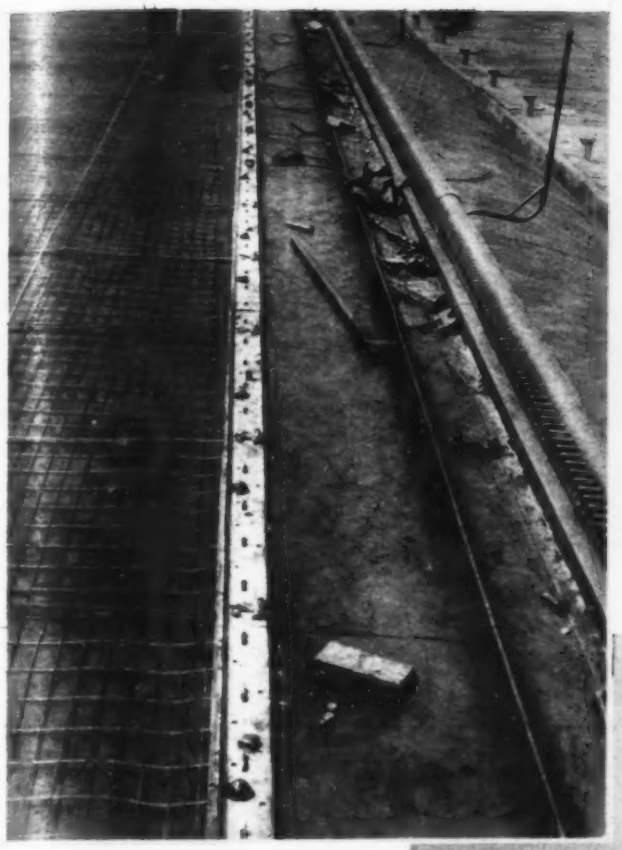
The supply problem calls for the mobilization of a large fleet of barges and towboats. The plant will use in



SYSTEM OF CABLES serves to moor and to maneuver the asphalt mattress sinking plant. Section of completed mattress is already launched and in place along river bank, while new section to form continuous sheet is being cast on mat barge.



BANK TACKLE is anchored to deadmen on shore with lines of wire cable extending to steel header forming in shore edge of first launch of reinforced asphalt mattress.



ON DECK OF CASTING BARGE wire mesh reinforcement is laid and connected along inshore edge to steel header angle to which launching cables are bolted for pulling mat into water.

DETACHABLE HOOK operated by manila rope, at end of toggle cable grips upstream edge of each mattress launch as it slips over side of barge and prevents river current from rolling it up. When mat is seated on river bottom hook is released by pull on manila rope.

STRIPS OF REINFORCING MESH on deck of casting barge are "stitched" together by special stapling machine (right) to form continuous sheet 218x30 ft. "sewed" to cables at 3-ft. intervals.

one day approximately 1,600 tons of mix, 1,000 squares of wire mesh reinforcing, 4,500 lin. ft. of wire strand and smaller quantities of other materials. This calls for a supply of about 1,000 tons of sand, 400 tons of loess, and 200 tons of asphalt per day. The sand is dug with a clamshell, as hydraulic dredging destroys the natural grading of the sand. The loess is dug with a bottomless drag scraper specially rigged for loading barges.

The mixing plant bears much the same relation to a land mixing plant that a battle ship does to a land fortification. All the conventional equipment of a fixed asphalt plant must be crowded on to one barge which results in a premium on space and freeboard. The plant has two direct type dryers for sand and one for loess. From the dryers the sand is transported by bucket elevators direct to the hot bin. The dried loess is passed over perforated plates with 5/16-in. openings, to eliminate extraneous matter, and is then elevated to a system of three electrically vibrated screens, with openings of 0.007 in. or smaller. The rejects from these screens are then passed through a hammermill and returned to the process. Almost all of the loess is thus used in the mix. Seventy-two square feet of screen area is provided, with open area of 46 per cent, capable of passing 20 to 25 tons of loess per hour into the bin.

On the mixing platform below the bins are two weigh hoppers, one for sand and loess, the other for asphalt which is pumped direct from the storage barges. The pugmill mixer has a capacity of more than 120 tons per hour, mixing a batch of 8,000 lb. The mixer is equipped with 24 teeth set to give a so-called run-around mix. From the pugmill, the mix is dumped into a receiving hopper which feeds it by means of a belt conveyor direct to the insulated bin barges which are brought alongside for transportation to the sinking plant.

The mix used for mattress work consists of from 12 to 13 per cent asphalt, from 22 to 26 per cent loess, and from 66 to 61 per cent sand. The plant has a capacity of from 60 to 100 tons an hour, depending on the mix used and the moisture in the aggregate.

The sinking plant consists of the mattress barge itself, a barge of hot mix alongside, the power plant, the main stringout and the mooring stringout. The bank is paved with unreinforced asphalt to within 3 ft. of the top, where the pavement is carefully toed into the bank to prevent rain wash from undermining it.

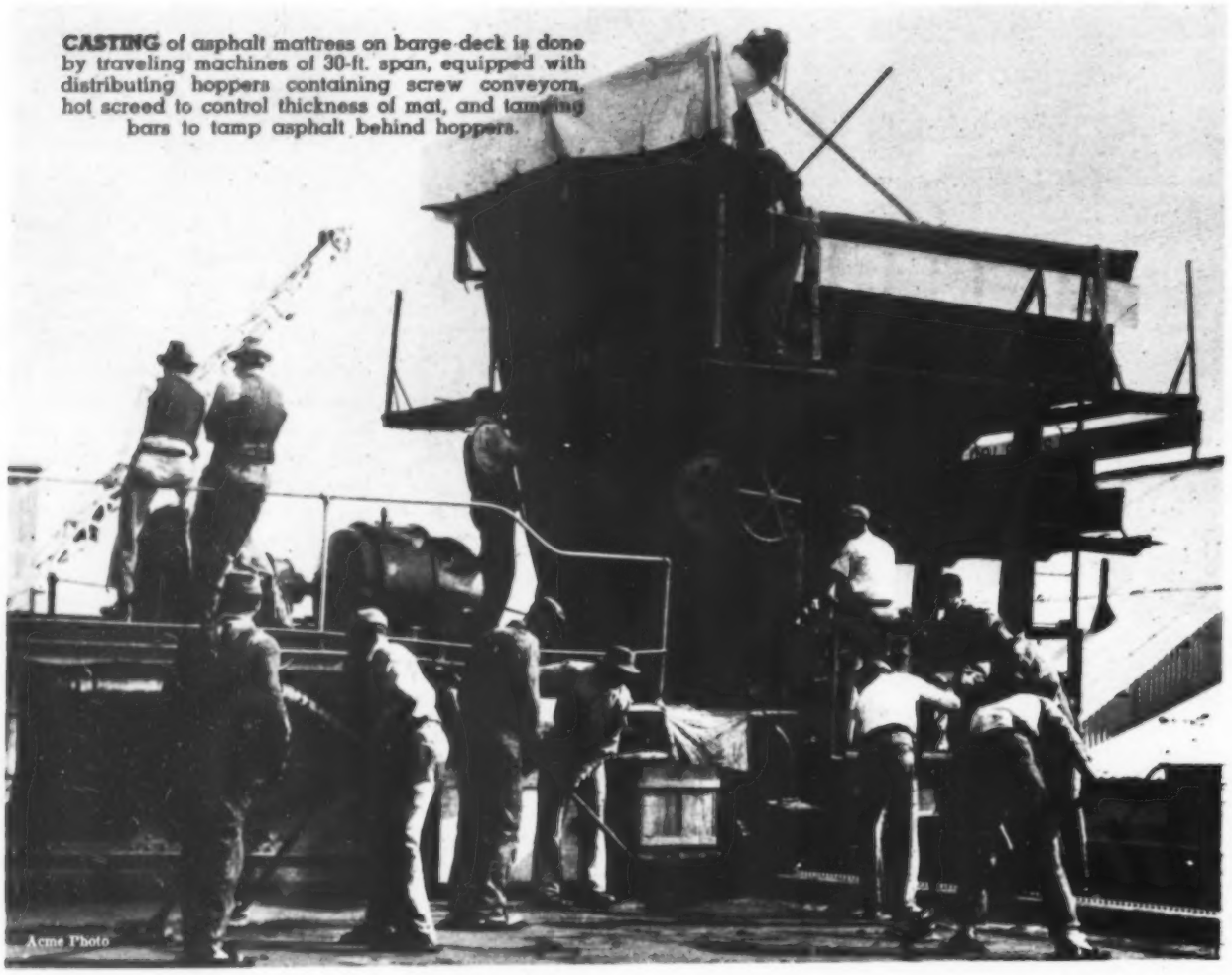
The plant is maneuvered by a system of cables, as illustrated in the accompanying sketch. The range is first laid out slightly downstream of normal to the current. The mattress barge is brought alongside the shore and a unit of mattress or launch is cast on the deck. This mattress is attached by means of a steel header to the bank tackle. By taking up on the cables the mattress is pulled from the deck to the shore, while the reinforcing and cables for the next launch of the mattress are automatically fed through the deck. Another launch of mattress then is cast and the mattress barge is moved back along the stringout, thus pulling a second launch from the deck. If necessary, the bank tackle is taken up sufficiently to insure the edge of the mat resting on dry land. The cycle is then repeated until the mattress has been completed, when a light tail header is built on the last launch, the reinforcing fabric is cut, and the mattress lowered to the bottom of the river by means of the launching cables, which are finally cut.

As each launch is slipped over the edge of the barge a cable, called the toggle cable, from the upper stringout, is attached to the upstream edge of the mattress by means of a detachable hook attached to a manila rope. These cables prevent the current from rolling the mat downstream while suspended in the river. After the mattress is safely on the bottom of the river, the cables are recovered by pulling the manila rope which releases the hook.

The sinking operation is controlled by a small model installed in the office on the stringout. This model shows two profiles, one of the upstream and the other of downstream edges of the mat. The model barge

is adjustable to any position from the shore out to the greatest distance at which mats are sunk. Mats 600 ft. long have been sunk in as much as 180 ft. of water. This is exceptional, however, the average mattress being about 500 ft. long and the depth usually being somewhat less than 100 ft.

Now let us take a look at the operations on the deck of the mat-



CASTING of asphalt mattress on barge deck is done by traveling machines of 30-ft. span, equipped with distributing hoppers containing screw conveyors, hot screed to control thickness of mat, and tamping bars to tamp asphalt behind hoppers.

Acme Photo

tress barge. Prior to casting the first launch a header, consisting of sections of heavy pressed steel angles is built along the inshore edge of the deck. The wire mesh reinforcing and the launching cables are bolted to the headers. The 6-ft. widths of fabric and cables then are securely stitched together with a special stapling machine, similar to that used for stapling papers. This operation results in a continuous sheet of reinforcing mesh, 218x30 ft., securely sewed to a series of cables at intervals of 3 ft. The staples are stronger than the reinforcing wire, so that no weakness in the mat results from their use. Under this sheet is placed the toggle cable, which is later to be hooked to the recoverable toggle cable already mentioned. This cable, which is clipped to alternate launching cables, strengthens the mat in the direction parallel to the river bank.

When the stapling operation has been completed, the first launch of the mattress is cast by means of two Barber-Greene finishing machines, having 30-ft. spans, specially constructed for this plant. The hopper, which receives the asphalt from the cars, contains a screw conveyor which distributes it the length of the machine. As the machine travels across the deck, the asphalt is fed out and tamped by the two tamping bars which immediately follow the hopper. Behind the tamping bars is a hot screed which smooths the mattress and controls its thickness. The tampers and screed are maintained at a temperature of from 300 to 325 deg. F. by circulating oil which is heated electrically and pumped through them. The tampers have an adjustable stroke from $\frac{1}{8}$ to $\frac{1}{2}$ in., and the speed may be varied by changing the sprockets from 400 to 800 strokes per minute. At present we are using a $\frac{1}{8}$-in. stroke and 600 strokes per minute. The machines travel at the rate of 14 ft. per minute, covering the distance from the center of the mattress to the edges in slightly under 8 min.

After a first spread has been made the machines return to the center, refill the hopper and repeat the operation, filling in cracks and improving the compaction of the asphalt. After the second tamping, the mattress is water cooled to 120 deg. F., launching takes place as previously described, and the cycle is repeated. After the first launch the entire cycle takes about 45 min. In other words, under favorable conditions, one 16-launch mattress per 16-hr. day can be sunk.

After three or four launches the bank crew disconnects the tackle, removes the deadmen and makes every other cable fast to screw anchors set in the bank. Of these cables fastened to the bank, every third one is of stainless steel.

On the lower deck, or shaft alley of the mattress barge the spools of reinforcing fabric and launching cables are arranged so that they may be fed through the upper deck in an orderly manner. It is of vital importance that strain be equally distributed to all of the launching cables. This problem was solved by using 73 figure-of-eight sheaves each wrapped with 60 ft. of cable. All these figures of eight are driven by self-locking worms connected to a common shaft operated by an electric motor controlled from the upper deck. In this way it is possible to pay out all cables equally and stop them all at the same moment. Also on the lower deck are located the pump for cooling and for ballast and the winches for maneuvering the mattress barge.

The upper bank paving completes the revetment operation. This unreinforced paving is spread and tamped by hand 3 in. thick. The mix is unloaded from the barge direct upon pallets on the bank. A drier mix, consisting of 10 to 11 per cent asphalt, 20 to 22 per cent filler and 70 to 67 per cent sand is used for this paving as the mattress mix is too sticky for use with hand tools. The upper bank paving completely embeds the header and the anchor cables in asphalt mix, thus affording some protection from the attack of the elements.

The asphalt mattress and asphalt levee and upper bank paving are a complete success and suggest that this method of protection should be considered on smaller streams where the investment for plant will not be great. The book value of our plant on the Mississippi, including all auxiliaries, is about $1,000,000, but the small experimental plant which was capable of producing a mat 30 feet wide cost only $50,000. On smaller streams where valuable city frontage is to be protected, it may be well to consider the asphalt mat rather than bulkheads or riprap.

DETAILS OF COST -- FISCAL YEAR 1937
ASPHALT MATTRESS

Unit Cost	Per Cent	
$0.18	1.15	Sand
0.22	1.41	Loess
1.17	7.60	Asphalt
0.63	4.09	Headers and staples
1.42	9.21	Wire strand
2.86	18.54	Wire fabric
1.42	9.14	Other materials
3.37	21.91	Labor
1.04	6.74	Towing
1.86	12.06	Plant rental
1.26	8.15	Overhead
Totals $15.43	100.00	

COSTS

			Towing	Plant rental	Overhead	Total
ASPHALT MATTRESS						
Materials $7.90 51.14%	Labor	$3.37 21.91%	$1.04 6.74%	$1.86 12.06%	$1.26 8.15%	$15.43 per 100 sq.ft. 100%
BANK GRADING						
Materials $0.021 34%	Labor	$0.020 31%	$0.002 3%	Plant rental $0.016 24%	$0.005 8%	$0.064 per cu.yd. 100%
UPPER BANK PAVING						
Materials $4.54 31.64%	Labor	$5.03 34.96%	$1.51 10.54%	$2.13 14.79%	$1.16 8.07%	$14.37 per 100 sq.ft. 100%
LEVEE PAVING						
Materials $6.609 61.10%	Labor	$2.264 20.94%	Towing 512 4.73%	Plant rental 588 5.23%	Overhead $0.866 8.00%	$10.817 per 100 sq.ft. 100%

DETAILS OF COST of reinforced asphalt mattress, including bank grading and upper bank paving.

Long Steel H-Piles

Support New Ford Buildings

STEEL BEARING PILES (right) are stored at Ford River Rouge plant ready for driving. Note closed bottom ends indicated by arrows.

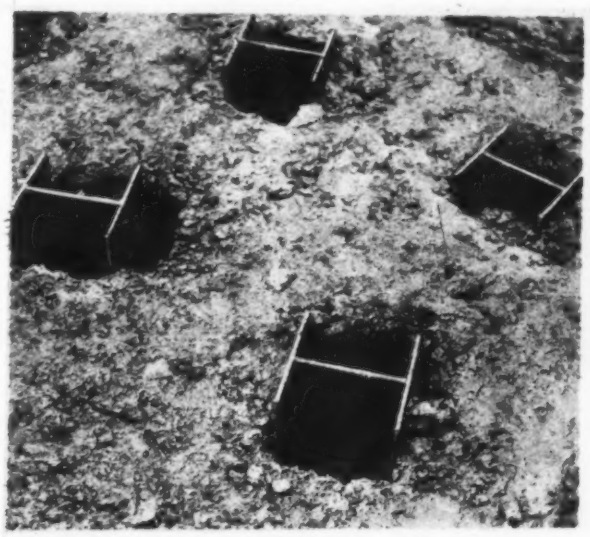
AT THE FORD MOTOR CO.'s River Rouge plant in Dearborn, Mich., the greatest lineal footage of steel bearing piles on record is being driven to provide a foundation for the new buildings in Henry Ford's $40,000,000 program of expansion. About 22,500 tons of steel bearing piles are being provided by the Carnegie-Illinois Steel Corp., equivalent to a total of about 828,000 lin. ft. of steel.

For the foundations of the Ford Motor Co.'s new press plant about 20,500 tons of the steel bearing piles will be required. A total of approximately 753,000 lin. ft., or about 8,000 individual piles are now being driven in the foundation of the new press plant. Other buildings, including a tool and die shop, a hot mill extension and mill transfer building, will require approximately 2,000 tons or 75,000 lin. ft. of steel bearing piles. The piles used, 12-in. C B P Section 124 steel bearing piles, weighing 53 lb. per lineal foot, would extend a distance of about 157 mi. if laid end to end. A feature of the piles is that each has a plate welded on the lower end. This plate, about 12½ in. square and 1½ in. thick, has stiffeners abutting at each corner along the inside of the flange. With a plate welded on to close the lower end of every pile, the pile reaches its required bearing capacity when driven a shorter distance into hard soil, so that shorter length piles are needed than would be the case were the plate omitted and the piles driven open-ended.

The steel bearing piles were shipped 4 days a week from the Carnegie-Illinois Homestead Works, Homestead, Pa., direct to Ford Motor Co.'s River Rouge Plant. Piles up to 105 ft. long rolled in single lengths, were sent by flat car, and because of these unusual lengths each load required three cars to carry it. A typical load consisted of 16 pieces of 105-ft. pile, weighing 45 tons, or 20 pieces of 100-ft. C B P pile, weighing about 55 tons. The average load on three flat cars was thus 50 tons, and 8 loads were shipped a day, or about 32 loads a week, a total of approximately 1,600 tons of bearing piles weekly from Homestead to River Rouge.

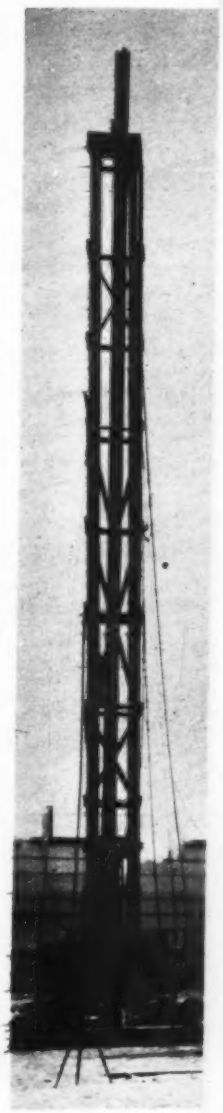
Rapid progress is being made in the installation of the foundations as a whole because of three time-saving factors accompanying the use of U. S. S. steel bearing piles. One reason is that the steel H-beam bearing piles have a high load capacity, and therefore fewer piles are required. Also, individual piles may be handled more rapidly because the single long lengths mean fewer pieces to handle and this, plus the easy driving of the piles, offers further advantages in speed and economy of installation. A third factor arises because there is no "heaving" of piles. The steel H-beam bearing piles, once driven, are permanently in place, providing a solid foundation for Ford's new press plant and other buildings.

STEAM HAMMER (below) gives final blows to steel bearing pile at site of new Ford press plant.

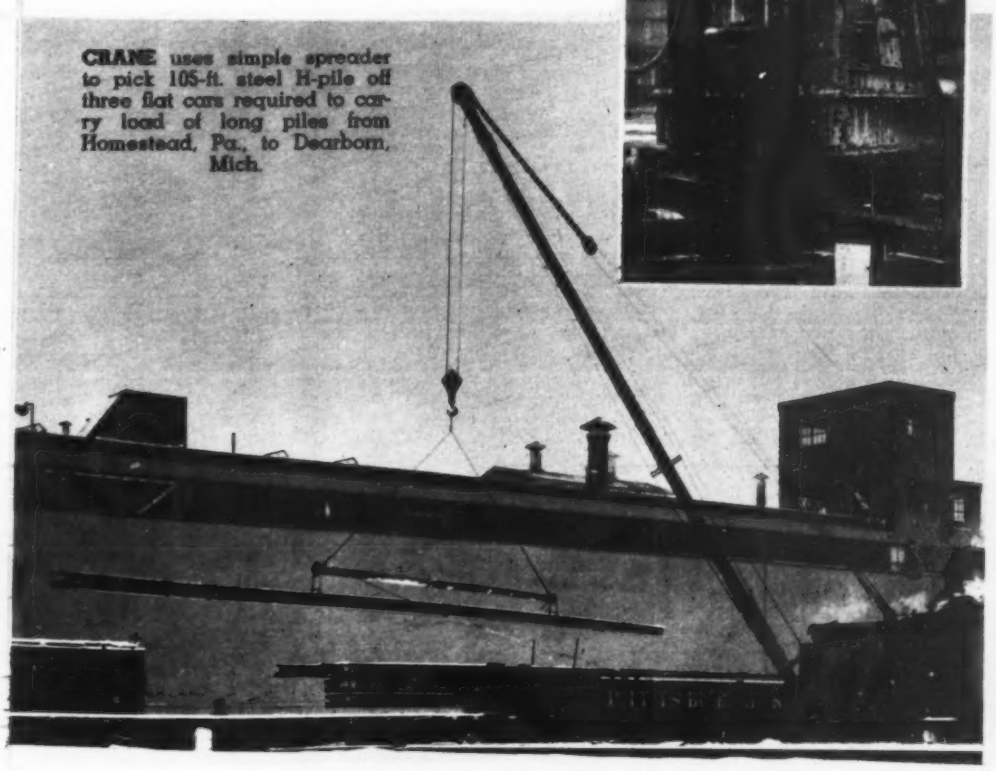


CLUSTER of four steel H-piles is ready for cap plates, after piles have been driven and cut off to grade. Closed plate bottoms of piles leave rectangular openings in soil.

LONG STEEL PILE (below) set in position by driving rig extends above top of tall leads.



CRANE uses simple spreader to pick 105-ft. steel H-pile off three flat cars required to carry load of long piles from Homestead, Pa., to Dearborn, Mich.



JOB ODDITIES

A MONTHLY PAGE OF

Unusual Features of Construction

DEEP SEA DIVER operates in new setting when he descends into icy water of Columbia River at Grand Coulee dam, in Washington, to help remove last of steel sheetpiling of cofferdams which, for three years, held river from flooding deep excavation for base of U.S. Bureau of Reclamation structure, built by Mason - Walsh - Atkinson-Kier Co. Diver uses intensely hot flame of acetylene and oxygen to cut off steel piling under water.

SHIFTING HEAVY EQUIPMENT to offshore cofferdam, in which spillway section of TVA's Guntersville dam on Tennessee River has been built, is accomplished by ferry barge with ramps at both ends. Trucks, wagon drills, and all equipment on wheels were run on to barge and shunted within range of 20-ton revolving crane at one end of the cofferdam. Units weighing up to 15 tons were easily lifted from barge and placed inside cofferdam by crane.

AISLE OF CROSSED SHOVELS, instead of the crossed swords traditionally associated with military ceremonies, gives construction touch to marriage of C. C. C. worker at Warrenton, Ore. Ethel Coban becomes bride of Lawrence Hanlon as Chaplain Julius Liebert performs forest ceremony on 9-ft.-diameter trunk of felled tree.

"That bum politician's always taking advantage of the crowds we draw!"

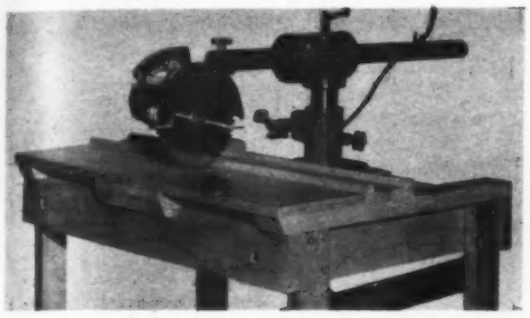
DOUBLE CROSSED! Unique highway underpass and bridge is built by Arkansas State Highway Department beneath Missouri Pacific Railroad bridge at George's Creek near Yellville, Ark., on U.S. Route 62.

CONSTRUCTION EQUIPMENT NEWS

(ALL RIGHTS RESERVED)

Review of Construction Machinery and Materials for APRIL, 1938

RADIAL SLIDE ARM for Speedmatic portable electric hand saws is designed and built to give users double utility. In less than minute without use of tools saw may be attached and used on any cutting



operation (within its depth capacity) that can be performed with any slide saw. Swings to any degree, right or left, for mitering, and tilts to 45 deg. for compound mitering and beveling. Attachment bracket may be turned to put saw in ripping, plowing or grooving position. All adjustments calibrated so that arm and saw may be locked accurately at any setting. Arm mounted on saw table 17 in. wide and 41 in. long. Arm stroke, 26 in. Outfit accommodates saws cutting 2 11/16-, 3-, and 3¾-in. depths. — **Porter-Cable Machine Co., Syracuse, N. Y.**

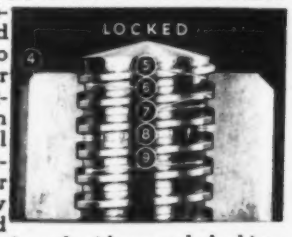
SAFETY HAT combines maximum strength with cool, lightweight wearing comfort. Duralumin (airplane metal) shell, designed for protection of workmen against falling or flying objects, is corrugated to provide maximum resistance to blows and does not absorb radiated heat even when worn in sunlight. Leather headband is spaced distance from shell to assure continuous air circulation. Cradle-straps and head-bands quickly interchanged and replaced. One size shell for all head sizes simplifies stock requirements. — **Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.**

PORTABLE A.C. LIGHT AND POWER PLANT, 300 to 10,000 watts capacity, is source of electricity at all points where regular supply is not available. Completely self-contained unit without accessories, except hand crank for starting. Upon arrival on job, unit may be uncrated, filled with gas or oil, hooked to line wires and set to delivering current. May be installed on stalwart box or, preferably, on concrete block about 30 in. from floor to make servicing easy. Vibration-absorbing, sponge-rubber mounting bolsters prevent transfer of vibration. Unique coupling between engine and generator provides bright, steady lights without usual disturbing flicker. Fuel consumption automatically reduced when less than full load of lights and appliances is placed on plant. Models, 2,000 watts and smaller, driven with air-cooled engines; larger sizes with continuous-duty, water-cooled engines. Photo shows highway worker using Kato plant for operation of standard 110-v. electric Star drill on concrete bridge abutment. — **Kato Engineering Co., Mankato, Minn.**

CABLE RIPPER especially for use on non-metallic sheathed duplex metals rips cables with one simple motion and eliminates necessity of using knife or other outworn method. Ripper is squeezed on to

cable and pulled, case-hardened cutting point ripping cable cleanly and accurately without gouging. May also be used for ripping outer sheathing of other cords such as lead cable where outside diameter is ⅝ in., or smaller—**Ideal Commutator Dresser Co., 4102 Park Ave., Sycamore, Ill.**

SELF-LOCKING SCREW THREAD PROFILE requires no extraneous part to produce positive lock of two threaded members to each other for entire length of thread engagement. Advantages: free spinning nut; rapid development of bolt tension; gradually increasing locking action; improved power or grip of lock; increased range of thread tolerances for manufacturing purposes. Photos show new relieved profile in locked and unlocked positions. (1) Root of bolt thread stepped at midpoint, each step tapered 6 deg. with axis of screw; (2) tapered crest of nut thread remains same as in older self-locking profile; (3) clearance between bolt and nut threads permits limited axial displacement and provides change in thread positions from unlocked to locked; (4) free-spinning nut meets work and wrench is applied, producing bolt tension; (5) as bolt stress increases nut thread is forced upward along tapered slope of bolt thread to point of greatest taper diameter; (6) with abutting thread flanks in contact additional wrenching develops required bolt load or stress; (7) shows how bolt stress is distributed between side of bolt thread ridge and locking surface; (8) due to resultant gripping action lock is unaffected by vibration, loss of bolt tension or wear of bearing surfaces of assembled members; (9) greater minimum thread diameters without V angles to start fracture develop greater strength.—**Dardelet Threadlock Corp., 55 Liberty St., New York City.**



ON YOUR NEXT JOB!

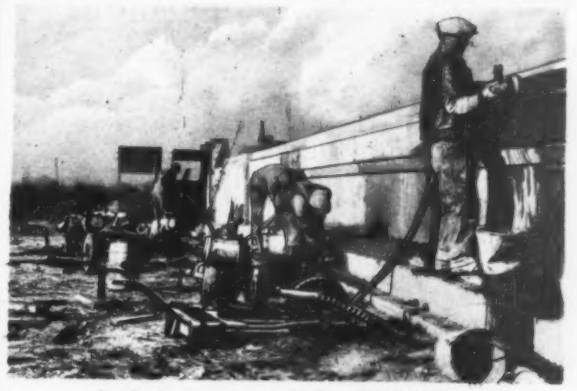
Save Time and Money with MALL Contractor's Equipment

CONCRETE VIBRATORS

A MALL Concrete Vibrator powered with a gas engine

There's a type and size — gas engine, air, or electric — for every construction job. Vibration frequencies varying from 3450 r.p.m. to 10,000 r.p.m.! In addition to savings in labor and material, MALL vibrators will improve the quality and appearance of every concrete structure.

CONCRETE SURFACERS



Surfacing concrete with a MALL unit

Gas engine and electric sets can be furnished. The gas engine or electric sets purchased for concrete vibrating can be used also for concrete surfacing or finishing. You get double service with MALL tools!

The MALL Model 2A Electric Handsaw

MALL PORTABLE ELECTRIC HANDSAWS

These powerful, safe, labor-saving electric tools will help you make bigger profits on every job. You can cross-cut or rip, *EASILY, CLEANLY, and ACCURATELY* ten times faster than any man can do the work with an ordinary handsaw.

It will pay you to investigate what these sturdy, dependable MALL tools will do on your job. Mail the coupon today for complete information!

MALL TOOL COMPANY
7757 South Chicago Ave., Chicago, Illinois

Without obligation, please send complete data on the equipment checked: ☐ Concrete Vibrators ☐ Concrete Surfacers ☐ Electric Handsaws

NAME .....

ADDRESS ..... CITY..... STATE.....

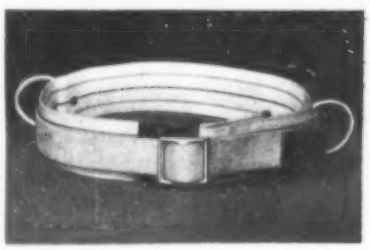
TODAY'S ALL-PURPOSE WORK HAT

MINE SAFETY APPLIANCES CO

M·S·A SKULLGARDS

On *every* type of work, they're wearing Skullgards now! Because Skullgards are light, easy-fitting—comfortable as any old felt working hat,—*with these extra values built-in:* high fracture resisting strength; insulation against electric shock; complete immunity to softening from water, perspiration or oil. Skullgards give real protection, not only from falling objects, but from all the painful bumps a man may suffer at any time *on any job.* 8 different styles. Send for Bulletin DK-6 . . . and let us arrange a demonstration for you!

TODAY'S PROTECTION AGAINST FALLING HAZARDS



M·S·A SAFETY BELTS

Safety belts don't have to be heavy and awkward to give proper protection! Men willingly wear modern M.S.A. Safety Belts on construction work because of their *lightness, convenience* and *complete working freedom*—yet every belt is tested for *strength* far exceeding any normal service requirement. Available in three harness types in addition to the popular Linen Web Body Pad Belt illustrated. Complete details on request—demonstrations gladly arranged. Write for Bulletin CF-1.

MINE SAFETY APPLIANCES COMPANY

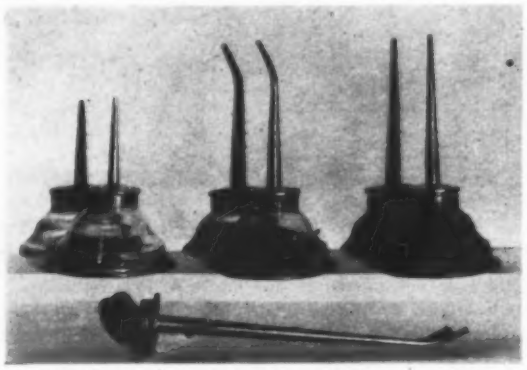
Braddock, Thomas & Meade Sts. Pittsburgh, Pa.

District Representatives in Principal Cities

M. S. A. Products include: Breathing Apparatus . . . Inhalators . . . Comfo Respirators . . . Masks of all types . . . Gas Indicators . . . Gas Detectors . . . Safety Goggles . . . Protective Hats and Caps . . . Edison Electric Cap Lamps . . . Safety Clothing . . . First Aid Equipment. Descriptive Bulletins will be sent on request.

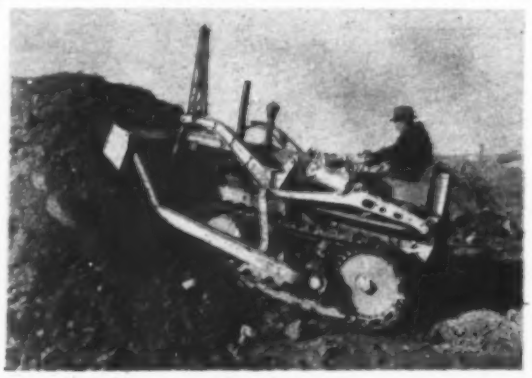
CONSTRUCTION EQUIPMENT NEWS... *Continued*

NOVEL OILER named "SCAN CAN" is made from transparent, non-breakable plastic material which is not affected by oil, gasolines or their derivatives. Danger of leakage is avoided by equipping them



with flexible copper plated metal bottoms. Spouts are of various types of heavy-gage copper plated material and may be unscrewed from body of can. Scan Can, ½-pt. size, is now available, with other sizes to be on the market soon. Besides light weight (⅓ less than metal can of same content) user has added advantage of being able to know quantity and grade of oil in can at all times. Eliminates unpleasant, wasteful habit of testing can contents by squirting oil on garage or shop floor.—**Universal Plastics Corp., 235 Jersey Ave., New Brunswick, N. J.**

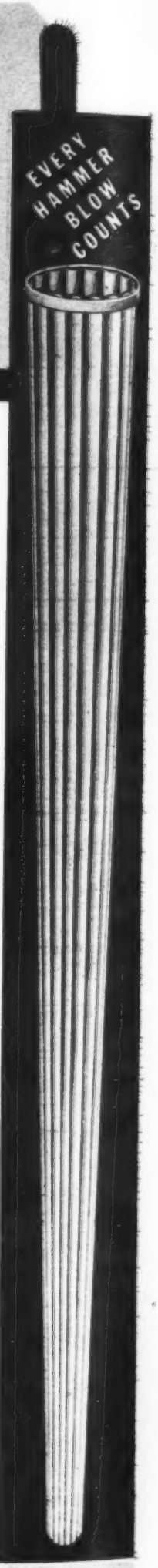
DIESEL CRAWLER TRACTOR (Model TD-35) operating with bullgrader (new addition to TracTracTor line) develops 43.37 maximum belt horsepower and 36.02 maximum drawbar horsepower. Powered by diesel-type four-cylinder engine. Has variable speed governors, five-speed transmissions with forward



speeds of 1¾ to 4 mi. and 2¼ mi. reverse per hour, ball bearings at 43 points, replaceable cylinders, Tocco electrically hardened crankshafts, special dust seals, fuel strainers, air cleaner, oil filter and unit construction throughout. Especially economical because it operates efficiently on cheaper grades of fuel and uses less fuel than conventional engine of corresponding size, making possible reduction of fuel transportation costs. Another new TracTracTor (model T-35) is identical with one described above, but is powered by a six-cylinder engine and operates with gasoline, kerosene or distillate. — **International Harvester Co., 180 N. Michigan Avenue, Chicago, Ill.**

FRICTION TAPE HOLDER worn on workman's belt prevents mislaying or losing of tape and eliminates possibility of roll falling under immovable objects or into oil or grease. May be rolled off as needed and used to last inch instead of being discarded when rolls get so small as to be unhandy to use. Holds tape firmly until used up.—**Ideal Commutator Dresser Co., 4102 Park Ave., Sycamore, Ill.**

WE MAKE 'EM YOU DRIVE 'EM

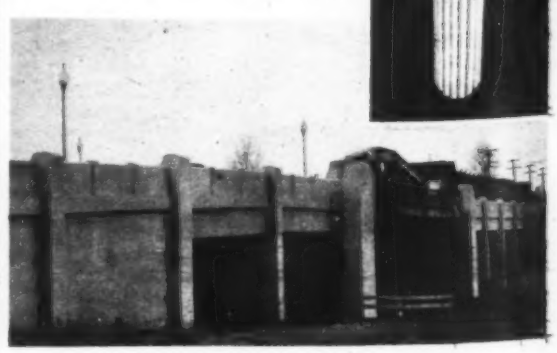


● Union Metal confines its activities to the manufacture of fluted steel shells for cast-in-place concrete piling. We are interested only in supplying a product which will enable you, the piling contractor, to install better substructures at a lower cost. That's why an ever-increasing number of contractors are bringing their piling problems to Union Metal. They are always assured of cooperation—not competition.

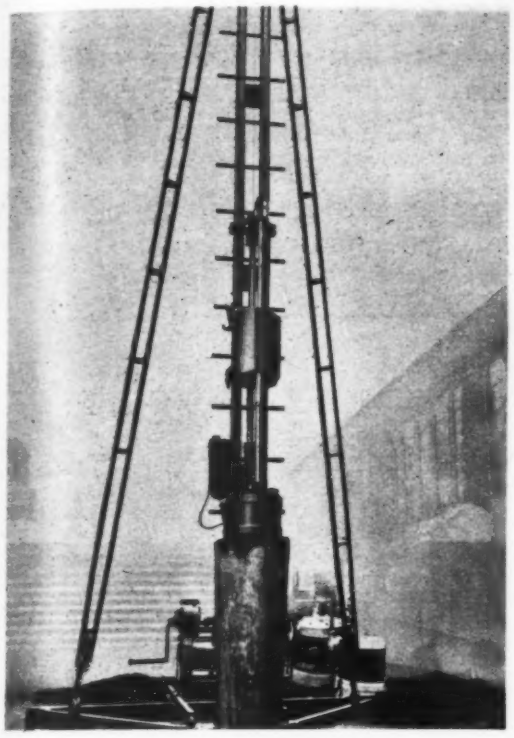
If you would like a catalog describing the many advantages of Union Metal Pile Shells, just drop a line to

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

● *335 Union Metal Pile Shells provide the substructure for the Franklin Street Viaduct, Washington, D. C. Contractors—Diamond Construction Co., Washington, D. C. Engineers—District of Columbia Engr. Dept.*



DIESEL PILEDRIVER applies diesel principle to piece of construction equipment which has heretofore required an outside power source. Resultant self-powered unit is used for driving light to medium piles and sheetpiling and is available in two sizes —660 and 990 lb. hammer weight. Driving assembly consists of hammer and base block connected by



two guide rods. Projecting upward from base block is piston and in hammer is cylinder. When hammer falls, piston compresses air in cylinder to about 440 lb. per square inch. At same time fuel is injected and resultant combustion throws head upward completing cycle when head falls of own weight. Number of blows regulated by throttle over range of 50 to 70 per minute, length of stroke varying from 2½ to 5 ft. 60-lb. hammer has driving force of 3,300 lb.; 990-lb. machine has force of 5,000 lb. Complete with tripod support. Readily portable. Requires two men to operate it. Fuel consumption, 3 qt. diesel oil per 8 hr. for 660-lb. model; 5 qt. for 990-lb. machine—**Calhoun Co., 1151 S. Broadway, Los Angeles, Calif.**

LIGHTWEIGHT, TWO-CYCLE DIESEL ENGINES in sizes ranging from 1 to 6 cylinders with capacities from 22 to 160 hp. are now available for use on small industrial operations, theaters, hospitals, irrigation projects, parking lots and other develop-

ments. Also can be used for any direct-drive prime mover operations, such as performed by tractors, hoists, trucks and pumps. Light weight, small size, compactness, low operating costs and freedom from necessity of special lubricants and fuels are distinguishing characteristics of these models and in addition, rotating masses and reciprocating forces are balanced by balancing mechanism which cancels vibration. — **General Motors Sales Corp., Diesel Engine Division, Cleveland, Ohio.**

LOWELL

REVERSIBLE RATCHET WRENCHES

This name represents the largest and oldest company devoting its entire time to the manufacture of Reversible Ratchet Wrenches — the tools that have been tried and proven. We manufacture and stock Reversible Ratchet Wrenches in sizes from 6" to 6 ft. long covering all Amer. and U.S. Std. nuts for ½" to 9⅛" across flats.

Send for our Catalogue R and ask about our guarantee

LOWELL WRENCH CO.
WORCESTER, MASS.

YOU CAN *EXPECT MORE* FROM A
STANLEY ELECTRIC TOOL

CUTTING GROOVES FOR 4" RING

... No. 342 STANLEY DRILL

It's all in the day's work for the Stanley No. 342 Drill — well balanced, smooth running ¾" Drill, especially built for heavy construction work, repair and production jobs. Powered and cooled for continuous operation. Seal type ball bearings support motor shaft. Detachable handle permits close quarter work. Chuck key held in gear housing. Positive cord clamp on drill stops cord from pulling out. A Stanley quality tool in every respect.

ASK YOUR STANLEY DISTRIBUTOR FOR A DEMONSTRATION.

Stanley Electric Tool Division, 140 Elm St., New Britain, Conn.

STANLEY ELECTRIC TOOLS
"COST LESS PER YEAR"

"Established 1885"

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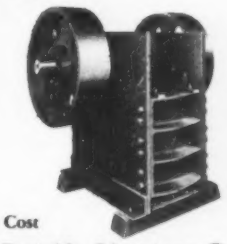
Road Building — Equipment —

"One Reduction" Roller Bearing Jaw Crushers

Saves 10% to 15% in Fuel
90% in Lubrication
More Production at Lower Cost



Mfrs. of Stationary or Portable Limestone Pulverizers, Gravel and Rock Crushing and Screening Plants, Conveying and Screening Equipment.

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No Tipping on Rough Mountainous Roads

Swing Hammer Portable Crusher

Ideal for Farm to Market Road Work

Adjustable Crushing Range from 2½" down to Agricultural Dust.

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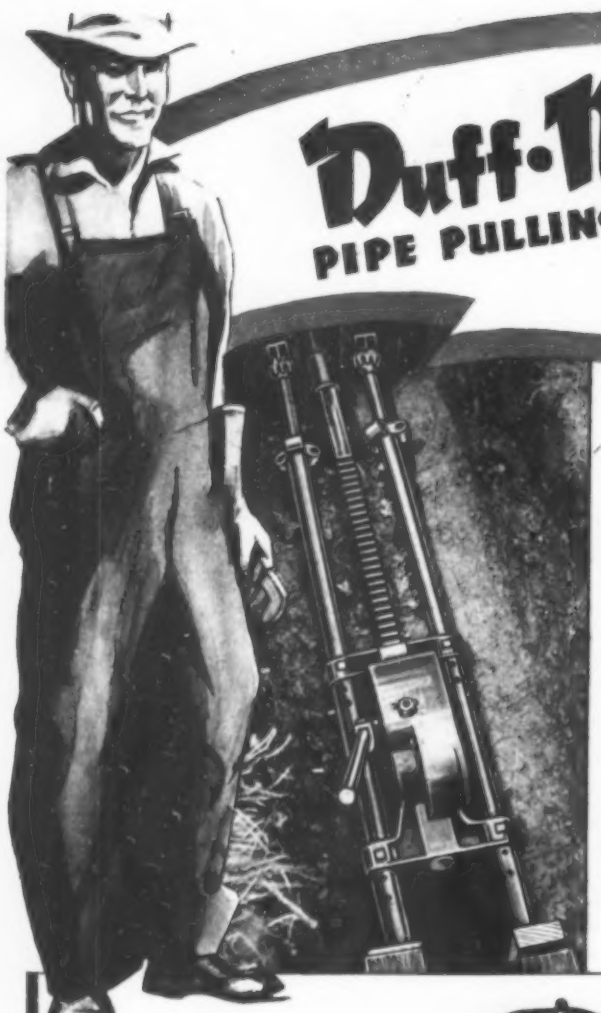
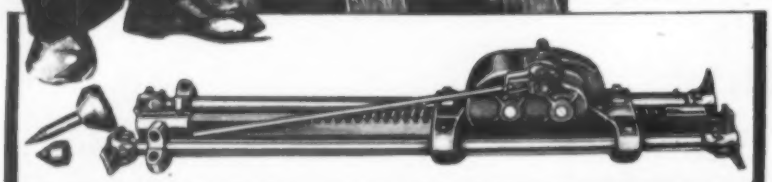


Duff-Norton
PIPE PULLING AND PUSHING Jacks

Save Enough Time to Pay for Themselves on the First Job!

Man—what a work saver . . . what a short cut to pipe laying under busy highways, boulevards, bridgeheads, railroad right-of-ways, etc. without the necessity of ditching or tunnelling! This new geared type Jack is, without a doubt, the most powerful tool of its type on the market designed for pulling or pushing pipe *without changing the position of the jack*. Save time and expense on future jobs by adding this dependable Duff-Norton unit to your construction tool equipment. Duff-Norton heavy-duty Jacks can also be furnished for pushing large culvert pipe up to 72-inch diameter. Solve your drainage problem once and for all!

Write for descriptive folder.



THE DUFF-NORTON
MANUFACTURING COMPANY
Pittsburgh, Pa.

A CLEAN SWEEP
4 to 7 M.P.H.

GRACE
ROAD SWEEPER

NO OTHER SWEEPER BUILT JUST LIKE IT

Tops for all types of flexible base, black top, retread and surface treatment, and for sweeping streets. Drawn by any light truck, tractor, team. Transports at 30-40 mph.

All wheels and shafts have antifriction bearings. Timkens on front wheels. Straight rollers in rear axle and countershafts. SKF double-row on brush. Brush angle pushes all sweepings completely to one side. Brush ends independently adjustable — sweeping width, 87". Fibre, stiff wire or regular wire brushes.

A swell investment for any community

W. E. GRACE MFG. CO.
1827 CHESTNUT STREET, DALLAS, TEXAS

MOVING?

NO MATTER— Where you move • How you move • or why you move . . . .

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CHANGE-OF-ADDRESS COUPON

CONSTRUCTION Methods and Equipment
330 W. 42nd Street, New York, N. Y.

Please change my mailing address

FROM { Name ..... Street ..... City ..... State .....

TO { Street ..... City ..... State ..... Company ..... Position ..... Nature of Business .....

CHANGE-OF-ADDRESS COUPON

CONSTRUCTION EQUIPMENT NEWS... *Continued*

PLASTER AND MORTAR MIXER for handling lime and cement mortars and patent plasters with hair or fibre, as required, features steel triple mixing hoes with adjustable blades which provide thorough

end-to-end mixing action and permit variation of action in accordance with job. Heavy steel plate, arc-welded drum, 6-cu.ft. capacity, has single unit hopper flared to permit charging by wheelbarrow without spillage. Multiple V-belt drive and grooved pulleys. Powered by Stover 3½-hp., four-cycle horizontal engine. Mounted on streamlined, one-piece, trailer-type frame with disappearing towing tongue. Steel wheels with Timken bearings and extra heavy, industrial balloon-type pneumatic tires. — **Construction Machinery Co., Waterloo, Iowa.**

PIPE PULLING AND PUSHING JACK, designed primarily for pulling and pushing pipe without changing position of jack. Capable of forcing pipe up to 6 in. in diameter, thus eliminating necessity of tearing up lawns, streets, or highways or holding up railroad traffic. Particularly useful for jobs common to contractors, plumbers, public utility companies, oil companies, municipal and railroad construction projects or wherever iron or steel pipe, electric conduit or lead cable must be laid. — **Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh, Pa.**

If You Want Further Information —

Within the space limits of these pages it is impossible to present complete information about the products illustrated.

If you want further details, write for them.

The Editor
CONSTRUCTION *Methods and Equipment*
330 West 42nd Street
New York, N. Y.

NEWS FROM MANUFACTURERS *About Their Products*

The publications reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

BELT MAINTENANCE MANUAL—**B. F. Goodrich Co.,** Akron, Ohio. (20 pp. illustrated.) Manual on care and maintenance of conveyor and elevator belting profusely illustrated with drawings and actual job photographs discusses such topics as (1) Why care of rubber belts is worth while; (2) Saving belt wear at loading points; (3) Protecting belts from trapped lumps; (4) How reduced speeds save belts; (5) How to make belt conveyors run straight; (6) Belt wear controlled by idler spacing; (7) Excessive tension — causes and remedies; (8) Effects of light, heat, cold and moisture; (9) How to install conveyor belts; (10) Fasteners; (11) Breaking in; (12) Splicing and repairing; (13) Specifying new conveyor belts; (14) Elevator belts — causes of rapid wear and injuries; (15) Elevator belts — how to install; tension formula.

• • •

DIRECT CURRENT MOTORS — **Fairbanks, Morse & Co.,** 900 S. Wabash Ave., Chicago, Ill. (8 pp. illustrated). Gives construction details of units designed to meet range of requirements and supplied in sizes up to 200 hp. with variety of modifications for both high and low voltage operation. Motors in ratings up to and including 7½ hp. at 1,750 r.p.m. are built with NEMA frame (284 frame and smaller) and mounting dimensions. Open construction, ball-bearing motors in ratings of 10 hp. at 1,750 r.p.m. and larger have frames especially adapted to larger machines.

• • •

PRECISION ADJUSTMENTS — **Laminated Shim Co., Inc.,** 21-24 44th Ave., Long Island City, N. Y. (16 pp. illustrated). In making adjustments on machines, filing, machining and grinding are eliminated by use of multiple layers of thin special alloy brass shim stock that may be quickly peeled off to give desired thickness. Laminum shims are cut to purchaser's exact specifications and fit bearings accurately, thus reducing time for making service adjustments on machines. Typical applications include outboard bearings, split bushings, crankshaft bearings, anti-friction bearings, frame assemblies. Shim stock is made up of 0.002 or 0.003-in. brass laminations.

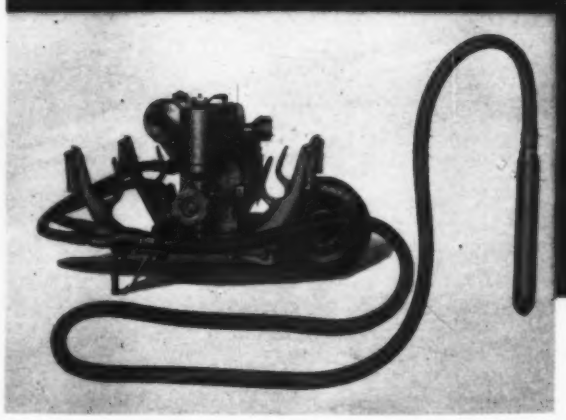
• • •

ELECTRIC DRIVE SELECTOR AND HINTS ON MAINTENANCE—**Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa. (12 pp. illustrated). Arranged particularly for non-technical or plant maintenance man, pamphlet describes and illustrates requirements to be met in selecting a motor. Chart shows how to choose motor, gives type of motors, applications and descriptions and includes concrete examples of installations. Another chart shows how to select the control and circuit protection. Motors for manual or magnetic controls indicated. Section of pamphlet devoted to maintenance with list of ten hints on preventive maintenance, such as planned inspection and maintenance, insulation cleaning and checking, and locating power loss.

• • •

CONSTRUCTION EQUIPMENT — **Construction Machinery Co.,** Waterloo, Iowa. (32 pp. loose-leaf, illustrated). Catalog presents modernized line of equipment and shows manufacturing facilities, world wide distribution and service organization of this company. Equipment described and illustrated includes concrete, bituminous, plaster and mortar mixers, self-priming pumps, hoists, saw rigs, wheelbarrows, pneumatic-tired concrete carts, and builders' equipment.

JACKSON HYDRAULIC CONCRETE VIBRATORS GRINDER DRILL



In One Quickly Interchangeable Combination

VARIABLE SPEEDS—DEPENDABLE—DURABLE

2¾" Standard vibrator head: 2¾" x 20". Recommended for all general concrete placing—adjustable frequencies.

1¾" Special 1¾" x 36". Vibrator head for thin or heavily reinforced sections—adjustable frequencies.

GRINDER

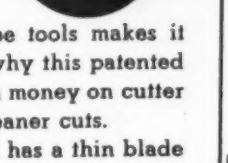
The grinder is easy to use—very efficient for surface rubbing of concrete. Five minutes required to change from the grinding wheel to boring attachment, using Jacobs 3-jaw chuck. Drills up to ½" diam. in metal or 1-1¼" in wood.

DRILL

In Jackson Hydraulic Vibrators you get the correct relationship of frequency and amplitude to size and weight for uniform consolidation of concrete designed for placement by vibration. Lubrication is no problem—all moving parts operate in the hydraulic medium —a high quality, light bodied oil. *Write today for more information.*

ELECTRIC TAMPER & EQUIPMENT CO., LUDINGTON, MICHIGAN

More and Cleaner Pipe Cuts with the RIDGID Cutter per cutter blade



• Your experience with pipe tools makes it easy for you to see at once why this patented RIDGID cutter saves you money on cutter wheels and gives you far cleaner cuts.

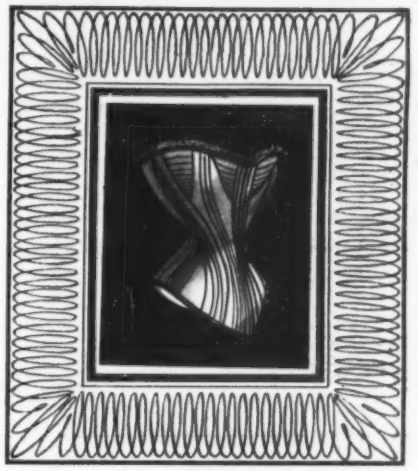
For the RIDGID wheel has a thin blade coined from special rolled alloy tool steel, hammered and heat-treated to give it extra guts, then assembled in a solid hub. It rolls right through any pipe, quickly, easily, leaving practically no burr. Far more cuts per wheel, saves you bother and expense of replacement.

Cutter housing reinforced, strong and true-cutting. A tool you enjoy owning and using. Hundreds of thousands in use. Try one at your Jobbers. For better cutting and economy, buy the RIDGID Cutter.

The Ridge Tool Co.

ELYRIA, OHIO

RIDGID PIPE TOOLS



FIGURES *Do* LIE!

You can't figure cable tensions on paper and be absolutely sure. Temperature, ice, sudden impacts, all are important factors that vary the cable tension, but are practically impossible to calculate.

But you can be sure when you actually *measure* it. Just clamp a Martin-Decker Cable Tension Indicator to the line and read your load *instantly*. It requires no deadening, and goes on or off the cable in an instant without wrenches.

THREE SIZES:

The Miniature — for lines and cables to 5/16". Capacity 200 lbs.

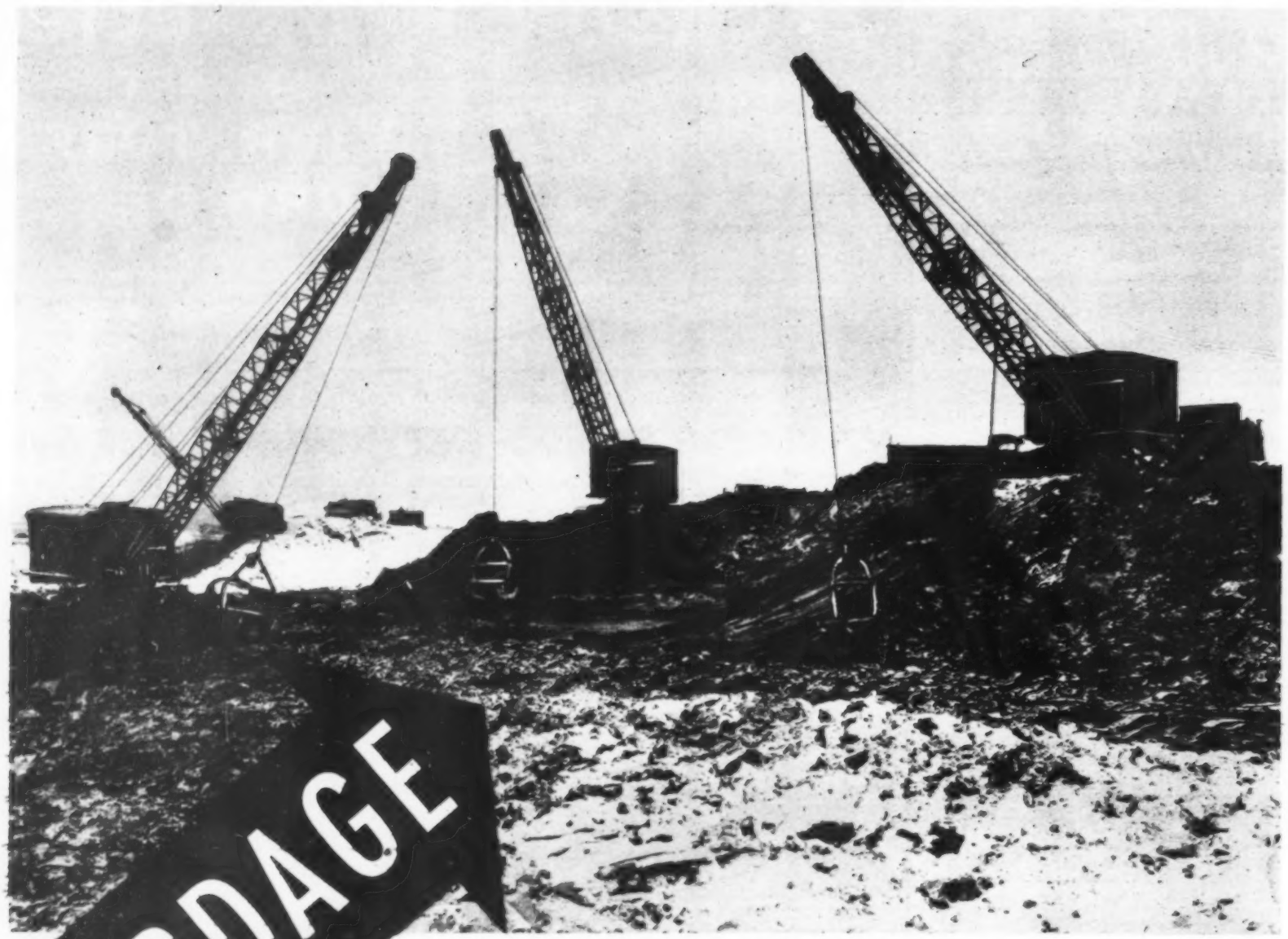
The Standard — for lines and cables ¼" to ⅝". Capacity 15,000 lbs.

The Heavy Duty — for lines and cables ⅝" to 2½". Capacity 250,000 lbs.

We also make a Travelling Line Indicator which measures loads on small lines whether they're moving or at rest. Write for detailed information!

MARTIN-DECKER CORPORATION

LONG BEACH CALIFORNIA



Three of the four 1—1¼ yd. BAY CITY machines purchased in the last two years are shown working on Detroit Sewerage Disposal Plant.

Chas. J. Rogers, owner of *FOUR* BAY-CITY machines, gets *yardage.*

No matter what the refinements of engineering design, *yardage provides the final pay-off*. Since 1920 users have recognized that as specialists in the small shovel field, BAY CITY machines are designed to out-perform and out-produce — will regardless of price give more yardage at lower cost.

Yardage with correct engineering design means efficient operation and low up-keep. That is why more and more users are comparing BAY CITY construction materials, design accessibility, speed, working range and safe load capacity with other machines in the same class. They compare, then *buy* BAY CITY shovels for economical and efficient operating service under toughest conditions.

For your *yardage producers* investigate BAY CITY Shovels, Draglines, Cranes and Hoes — 12 models, ⅜ to 1¼ cu. yds. — fully convertible.

MR. ROGERS WRITES TO A SHOVEL BUYER:—

"We have owned both makes of machines . . . and find . . . the BAY CITIES have been a lot more profitable. The Bay City machines have cost a lot less to operate and are much easier to move on the job . . . We feel that we have made a better choice in buying BAY CITIES."

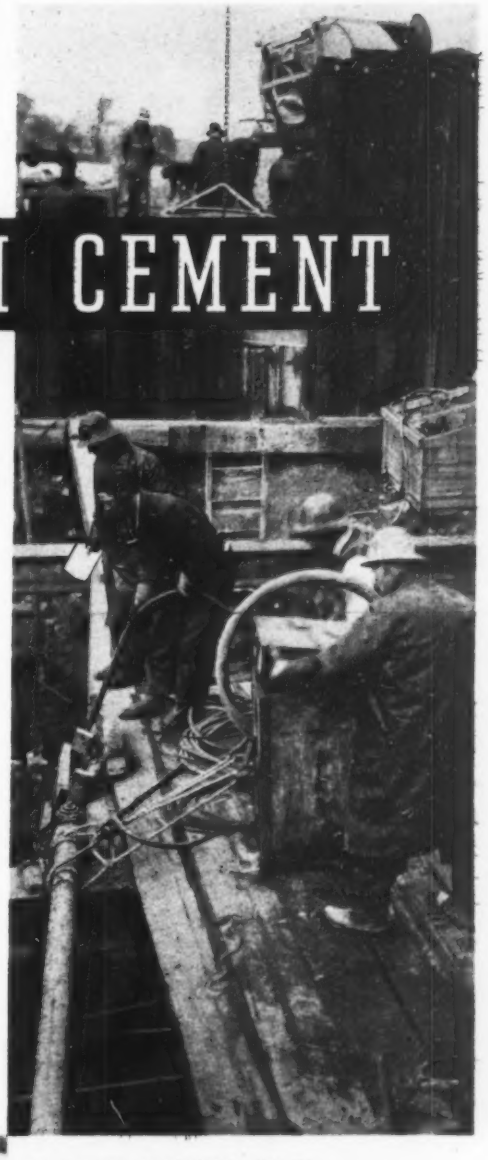
BAY CITY SHOVELS Inc. BAY CITY, MICH.

Cable Address "DREDGE"

BAY CITY SHOVELS

A Boiling Spring was Stopped *with*

LEHIGH EARLY STRENGTH CEMENT



During sewer construction when rock faults permitted a bubbling spring to enter an open cofferdam, Lehigh Early Strength Cement quickly met the emergency. Its extreme plasticity made it easy to completely fill the fissures when the grout was pumped. Its quick hardening enabled the job excavation to go ahead in 48 hours.

Because of its plasticity, for maximum watertightness and time saving, later in the operation Lehigh Early Strength Cement again was used to meet an emergency in shutting off a boiling spring entering the tunnel. In spite of a 20° slope tremie, the concrete was placed successfully, and in 48 hours was subjected to the water pressure. Compared with the use of normal portland cement, quick service concrete saved a week in construction time, with a corresponding saving in overhead expense.

For quick service concrete under any conditions, use Lehigh Early Strength Cement. For almost every job, in whole or in part, its use expedites the construction schedule to effect economies. The Lehigh Service Department will gladly answer any questions.

Sewer Work, Buffalo, N. Y.
Black Rock Harbor Intercepting Sewer Underpass
Contractors: L. A. Wells Construction Co., Cleveland, O. R. A. Boccia, Gen. Supt. Thomas Bell, Field Engineer.
Engineers: Greely & Hansen, Buffalo and Chicago.

LEHIGH PORTLAND CEMENT COMPANY

Allentown, Pa. Chicago, Ill. Spokane, Wash.

new 603 KOEHRING

KOEHRING HEAVY DUTY

Enclosed gears, anti-friction bearings, independent selective swing and travel speeds, and high line speeds, are a few outstanding advantages of the new Koehring 603 Excavator. It handles a 1½ yard dipper as a shovel, and is fully convertible to dragline, crane or pull shovel.

Send for the New 603 Bulletin

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

All Perfectly BALANCED

Your experience has proved that flexibility is a vital characteristic of wire rope. But your experience has also proved that a rope which sacrifices other essential characteristics to gain flexibility will not stand up on the job.

Consequently, flexibility is one of the characteristics always to be found in "HERCULES" (Red-Strand) Wire Rope—*plus* these other equally essential features—strength . . . elasticity . . . toughness . . . and durability. All perfectly balanced to assure better . . . longer . . . and more economical performance.

Your first trial will convince you that "HERCULES" (Red-Strand) solves your wire rope problem the economical way. Try it on your next job.

For Maximum Efficiency in Preformed Wire Rope, Use . . .

PREFORMED
"HERCULES"*
RED-STRAND
WIRE ROPE

Available in Both Round Strand and Flattened Strand Constructions

*Reg. U. S. Pat. Off.

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San Francisco.....520 Fourth Street
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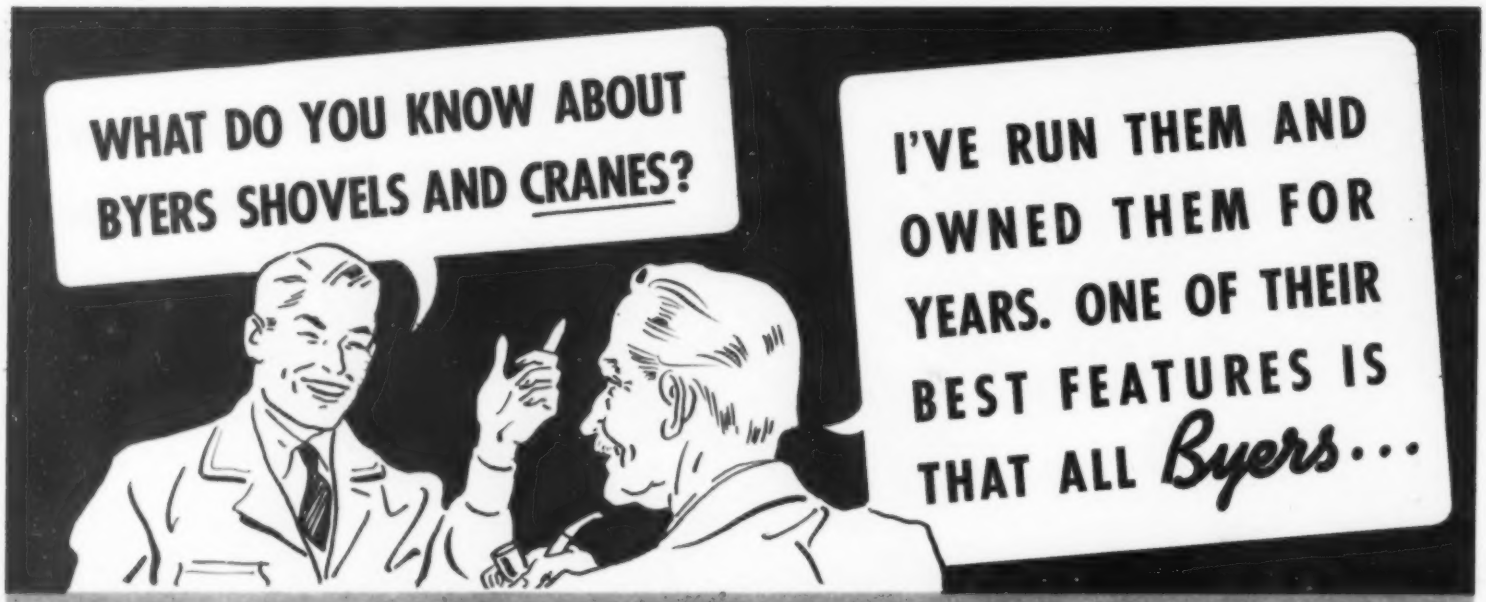
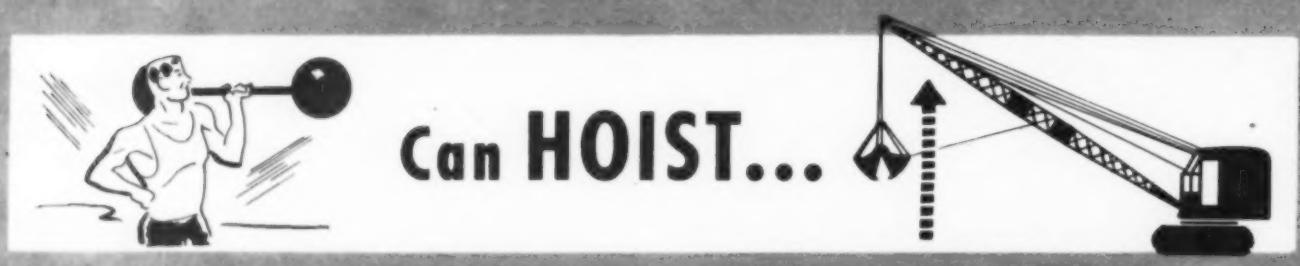
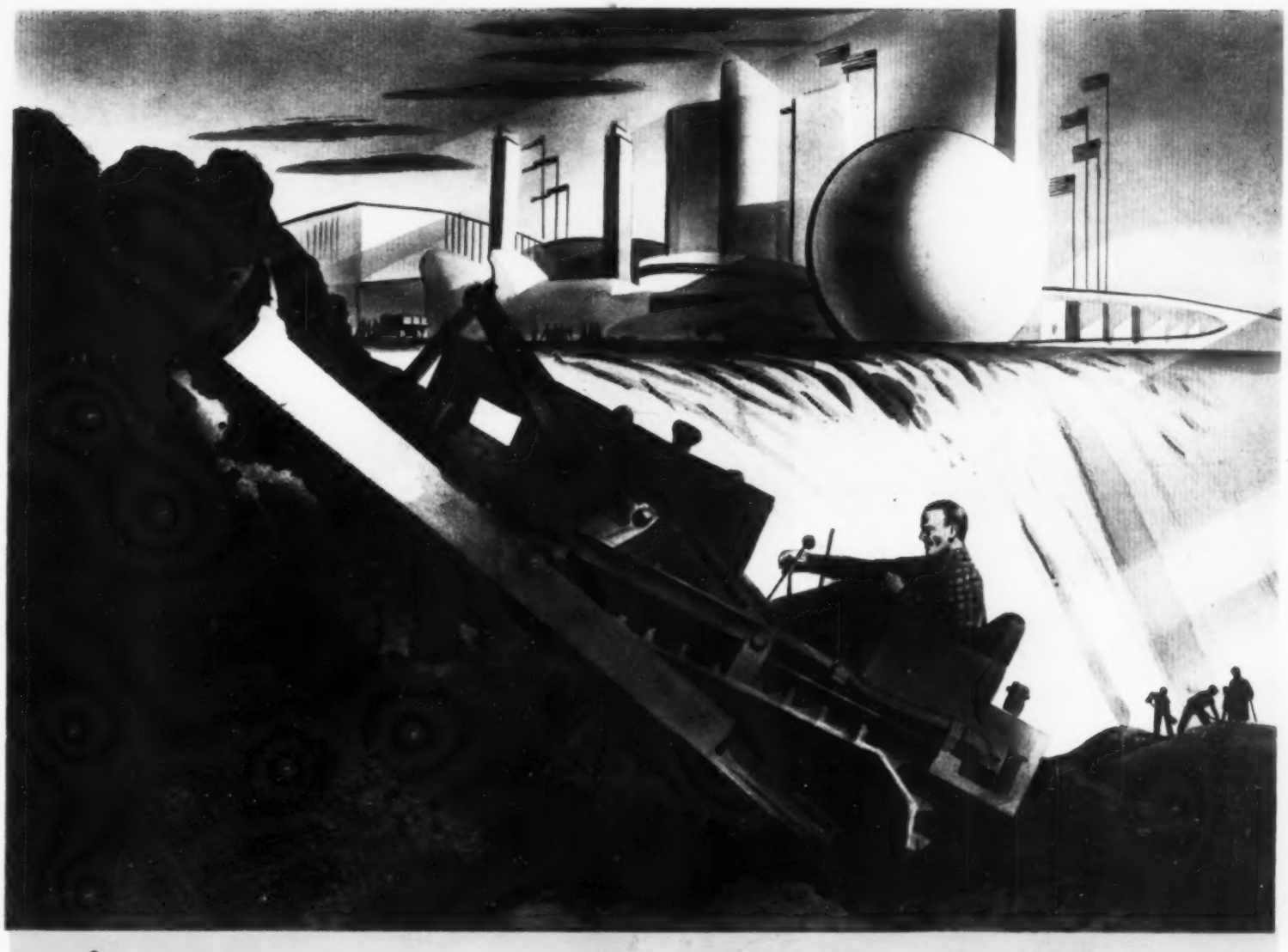

WHAT DO YOU KNOW ABOUT BYERS SHOVELS AND CRANES?
I'VE RUN THEM AND OWNED THEM FOR YEARS. ONE OF THEIR BEST FEATURES IS THAT ALL Byers...



The Byers Machine Company • Ravenna, Ohio

BYERS

SHOVELS • CRANES • DRAGLINES • TRENCH HOES



$2,000,000 for a Front Yard

Modern lubrication helps create rolling lawns from swampland at New York World's Fair

A MODERN WONDER in the construction world is taking shape at the site of the 1939 World's Fair. Work goes on feverishly, night and day . . . and from the Flushing Meadows rises a city. Swamplands are changed to rolling lawns!

Madden and Lane, Inc. of New York was one of the contractors chosen for this tremendous task. They knew the job faced by their 18 new Heavy Duty Bulldozers and Tractors. Operation had to go on 16 hours a day, every day, in all kinds of weather, over swampy, treacherous terrain.

Called in by Madden and Lane, Shell engineers went to work. Equipment was surveyed, working conditions analyzed.

The Shell men saw that they were faced with a threefold problem: To provide an oil which would satisfactorily operate the hydraulic rams used to raise and lower pusher blades. To provide a lubricant that would stay on tractor rollers despite the ravages of heavy, wet soil. To provide a transmission lubricant which would stand up under the heavy "tooth pressure" on the transmission gears caused by the abnormally heavy loads.

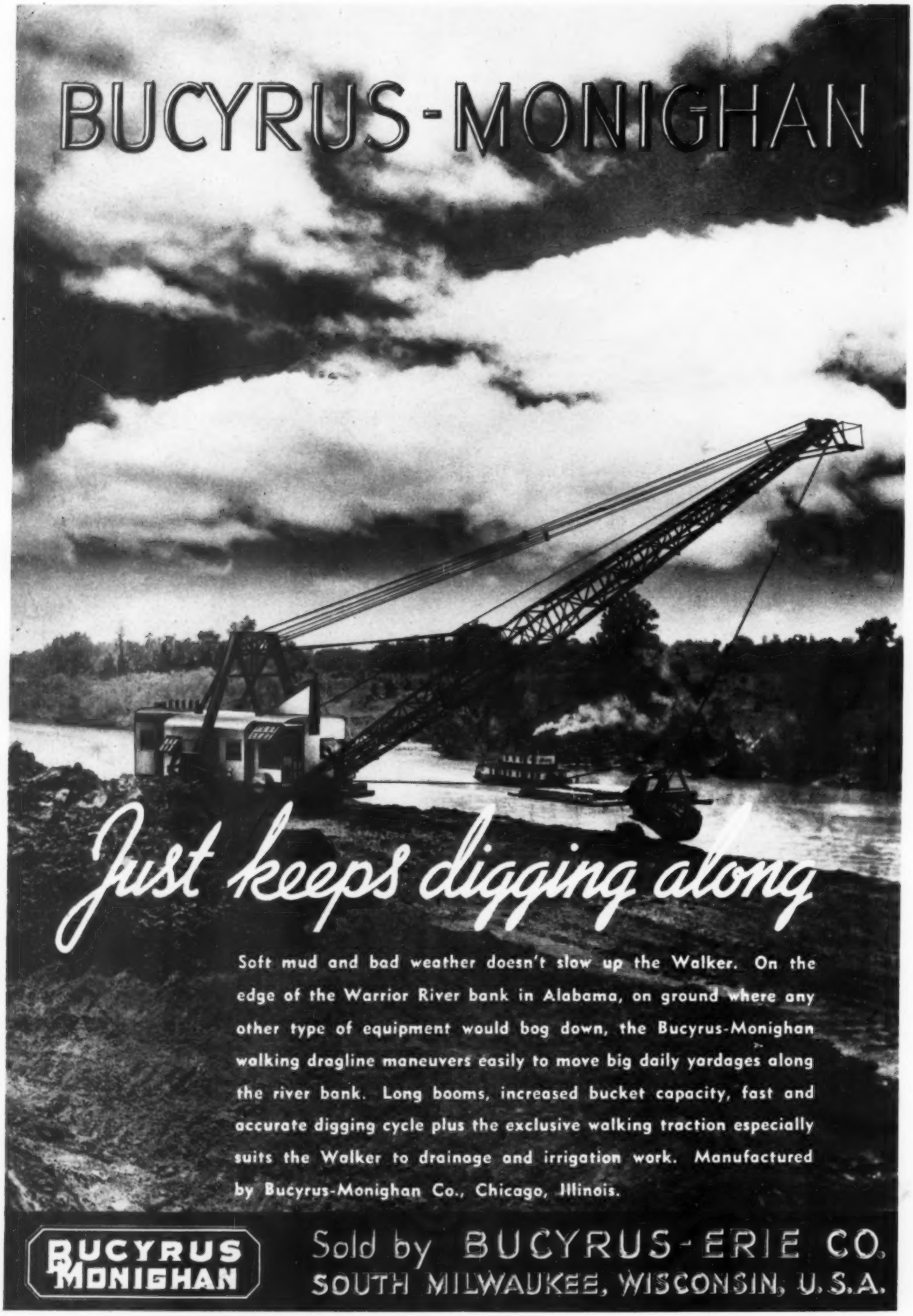
To meet these problems, three outstanding Shell Construction Lubricants were recommended and applied. Operating day and night in the Madden and Lane equipment, they have proved themselves equal to every demand. High maintenance and labor costs have been considerably reduced. Lubrication costs are being held to a minimum, while the productive work of both manpower and machine power is at a peak!

. . .

Time after time this same story is being repeated. *Shell meets the test!* Shell brings to *your* problem a great *plus* in lubrication: The finest lubricants being refined today . . . The "know how" to meet every problem of the construction industry. When you want results—let this *plus* help you. Call or write your nearest Shell office.

SHELL

SHELL CONSTRUCTION LUBRICANTS


BUCYRUS-MONIGHAN
Just keeps digging along
Soft mud and bad weather doesn't slow up the Walker. On the edge of the Warrior River bank in Alabama, on ground where any other type of equipment would bog down, the Bucyrus-Monighan walking dragline maneuvers easily to move big daily yardages along the river bank. Long booms, increased bucket capacity, fast and accurate digging cycle plus the exclusive walking traction especially suits the Walker to drainage and irrigation work. Manufactured by Bucyrus-Monighan Co., Chicago, Illinois.
BUCYRUS MONIGHAN
Sold by BUCYRUS-ERIE CO.
SOUTH MILWAUKEE, WISCONSIN, U.S.A.

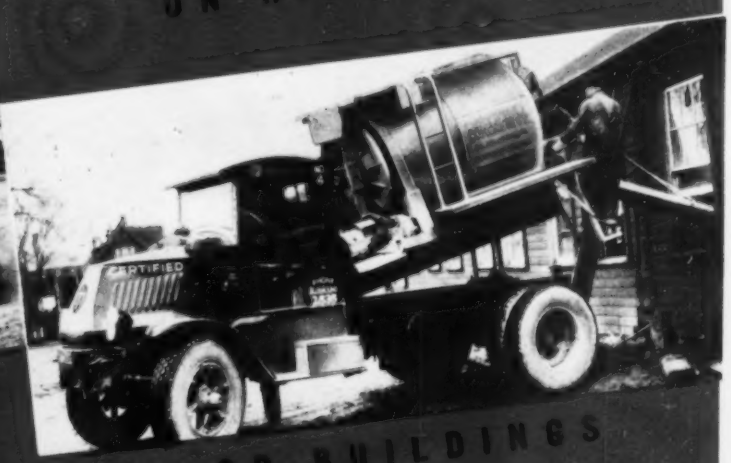
Moto-Mixers Show

HOW TO OUTBID THE OLD STUFF!

ON AQUEDUCTS

ON HIGHWAYS

ON TUNNELS



OR BUILDINGS

Are you getting your share of the concrete jobs in your territory?

One look at the list of "Bids Awarded" in your territory shows in most cases that the contractor who gets the job is the one who bases his bid on the cost of doing his job with modern machines and methods.

That's why, before they place their bids, more and more contractors are estimating the savings possible when Rex Moto-Mixers are used for mixing, hauling and placing concrete. Moto-Mixers with their fast, efficient service make it practical to bid on more types of jobs *and to keep the bids low!*

If you want a greater share of the jobs in your territory, investigate Rex Moto-Mixers today! They'll show you how easy it is to outbid the old stuff.

Now

GET THIS NEW FREE BOOK!

"Payloads for '38"—shows in black and white the many advantages you gain by turning to Rex Moto-Mixers and Agitators for your concrete mixing, hauling and placing jobs. A copy will be sent you free of charge upon your request. Use handy coupon below.

CHAIN BELT COMPANY
1664 W. Bruce Street, Milwaukee, Wisconsin
Gentlemen: Please send me my copy of "Payloads for '38."

Firm Name .....

By (Title) .....

City ..... *State* .....

REX

MOTO-MIXERS

CHAIN BELT COMPANY of Milwaukee

Only ADNUN can offer Hydraulic Controls

THE new Adnun Black Top Paver decidedly "steps up" paving operations with this exclusive feature. Hydraulically operated and controlled from a single lever bank, the entire equipment manipulation is performed faster and with no physical exertion. This permits the operator to make almost instant adjustments to meet every condition and allows him more freedom to watch his work.

These Adnun features are:

1. Power cut-off gates in the hopper in four sections, each section individually hydraulically controlled.

2. End gates lift for delivery of material to curb or shoulder direct from the hydraulic control bank.

3. Screed with overlapping action instantly lifted at either or both ends for Super Elevation or for passing over manholes or other obstructions.

These features are the key to better road paving—the way to bigger profits—and they can be bought only on the Adnun.

See the new Adnun Black Top Paver before you make your buy.

THE FOOTE COMPANY, INC., Nunda, New York

ADNUN
TRADE MARK REGISTERED

BLACK TOP PAVER
with Hydraulic Controls

When You Move the Earth

International Industrial Power has brought *economy* to highway maintenance for years. Here is an International Diesel-powered motor patrol, cutting costs wherever it works.

An International T-20 TracTracTor pulling a sheep's-foot roller, and in the background a larger International with bulldozer.

This is the International T-40 TracTracTor bulldozing dirt. An International Diesel engine is also available for this sturdy crawler. International Industrial Tractors are readily adapted to a wide variety of in-built equipment.

● More dirt-moving is being turned over to International TracTracTors all the time because they have the stamina this rough-and-tumble job demands. In no other service does TracTracTor design and International Harvester *quality* construction show to better advantage. Year-after-year performance on the job has proved the value of the many features International Harvester has brought to the crawler-tractor field.

International TracTracTors convert an *exceptionally large percentage* of their engine power into useful work. All vital parts are *completely protected* against entrance of abrasives and water. No matter how thick or penetrating the dust, the oil seals in TracTracTors keep it out. Steering clutches, operating on high-speed shafts, permit *"finger-tip" control* that gives *extra quick* response and *extra ease* of operation. Steering clutches and brakes are *so readily accessible* that they can be inspected, adjusted, or replaced in a minimum of time.

Such things as these are reflected in the cost sheets — they make possible the *economy of operation and maintenance* for which TracTracTors are famous. These crawler tractors are available in five different models, for gasoline and Diesel operation. There also are five wheel tractors in the International line, and power units ranging up to 110 max. h. p. Ask the nearby International dealer or Company-owned branch for complete details.

INTERNATIONAL HARVESTER COMPANY

180 North Michigan Avenue (*Incorporated*) Chicago, Illinois

INTERNATIONAL Industrial Power

FOR SALE:

BETTER RESULTS

Tarmac

MAKES GOOD ROADS

. . . AN INTERVIEW

FOR SALE: **Tarmac**—THE ROAD WITH THE HIGH COEFFICIENT OF SAFETY

WITH A SUCCESSFUL HIGHWAY OFFICIAL

. . . . . OUR NEW CONSTRUCTION IS BUILT WITH TARMAC, WHICH WE HAVE FOUND GUARANTEES A LASTINGLY SKID-RESISTANT SURFACE, AND. . . . . .

OLD SLIPPERY ROADS OF OTHER TYPES HAVE BEEN MADE SAFE WITH INEXPENSIVE TARMAC TREATMENTS.

MR. JONES, ARE THESE SMOOTH-RIDING TARMAC ROADS ALL BUILT ALIKE?

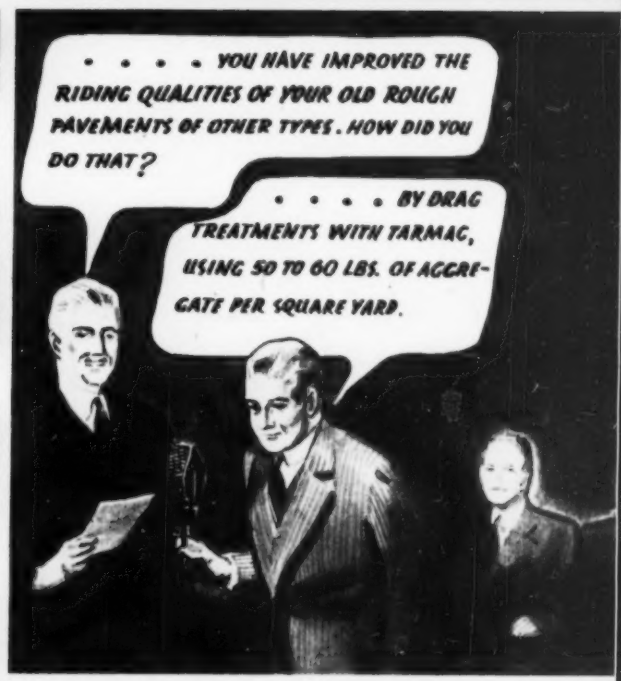
. . . . . WHY DO YOU USE TARMAC FOR YOUR BITUMINOUS WORK?

. . . . . BECAUSE WE FIND THAT FOR PRIME COATS, TARMAC NOT ONLY PENETRATES, BUT AT THE SAME TIME BINDS TOGETHER THE SURFACE PENETRATED

WHILE FOR MIXED SURFACES, TARMAC MIXES MORE READILY WITH OUR LOCAL AGGREGATES AND, IN ALL TYPES, THE FINAL TARMAC SURFACE LASTS LONGER AND IS SAFER THAN ANY OTHER TYPE.

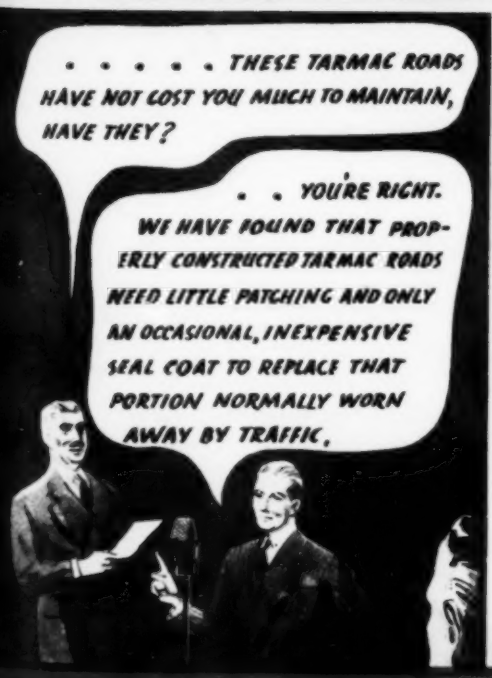
. . . . YOU HAVE IMPROVED THE RIDING QUALITIES OF YOUR OLD ROUGH PAVEMENTS OF OTHER TYPES. HOW DID YOU DO THAT?

. . . . BY DRAG TREATMENTS WITH TARMAC, USING 50 TO 60 LBS. OF AGGREGATE PER SQUARE YARD.



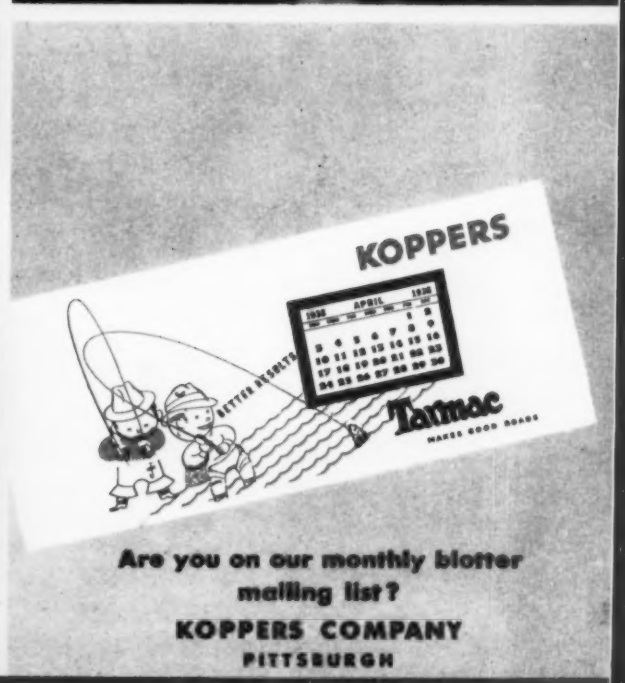
. . . . . THESE TARMAC ROADS HAVE NOT COST YOU MUCH TO MAINTAIN, HAVE THEY?

. . YOU'RE RIGHT. WE HAVE FOUND THAT PROPERLY CONSTRUCTED TARMAC ROADS NEED LITTLE PATCHING AND ONLY AN OCCASIONAL, INEXPENSIVE SEAL COAT TO REPLACE THAT PORTION NORMALLY WORN AWAY BY TRAFFIC.



. . . . YOU ARE PRETTY WELL "SOLD" ON TARMAC, AREN'T YOU?

. . . . . WHY SHOULDN'T I BE? WE'VE USED IT FOR A GOOD MANY YEARS, AND I THINK OUR ROADS SPEAK FOR THEMSELVES. THAT'S WHY I SAY — YOU GET BETTER RESULTS WITH TARMAC.



Are you on our monthly blotter mailing list?

KOPPERS COMPANY
PITTSBURGH

a KOPPERS product

CHEVROLET TRUCKS

again prove their great performance and economy by this A.A.A. CERTIFIED TEST RUN

CONTEST BOARD · AAA · AMERICAN AUTOMOBILE ASSOCIATION · CERTIFIED TEST

SANCTION NO. 3562

1938 1½-ton stock model Chevrolet truck demonstrates cost-saving performance in test run from the capital of Canada to the capital of Mexico

less than ⅓ CENT PER TON MILE

14.48 MILES PER GALLON of gasoline

NOT ONE CENT FOR REPAIRS

CHEVROLET No tests are more rigidly supervised and exacting than tests conducted under the supervision of the Contest Board of the American Automobile Association. All figures listed in the column at the right are *facts*—certified and convincing proof of the great performance qualities and dollar-saving economy of Chevrolet trucks! Modernize your truck equipment now. Save money *all ways* with Chevrolet trucks—with low first cost, low operating cost, low maintenance expense—and with rugged, durable Chevrolet construction that gives extra thousands of miles of capable, satisfying operation.

CHEVROLET MOTOR DIVISION, *General Motors Sales Corporation*, DETROIT, MICHIGAN

General Motors Instalment Plan—Convenient, Economical Monthly Payments. A General Motors Value.

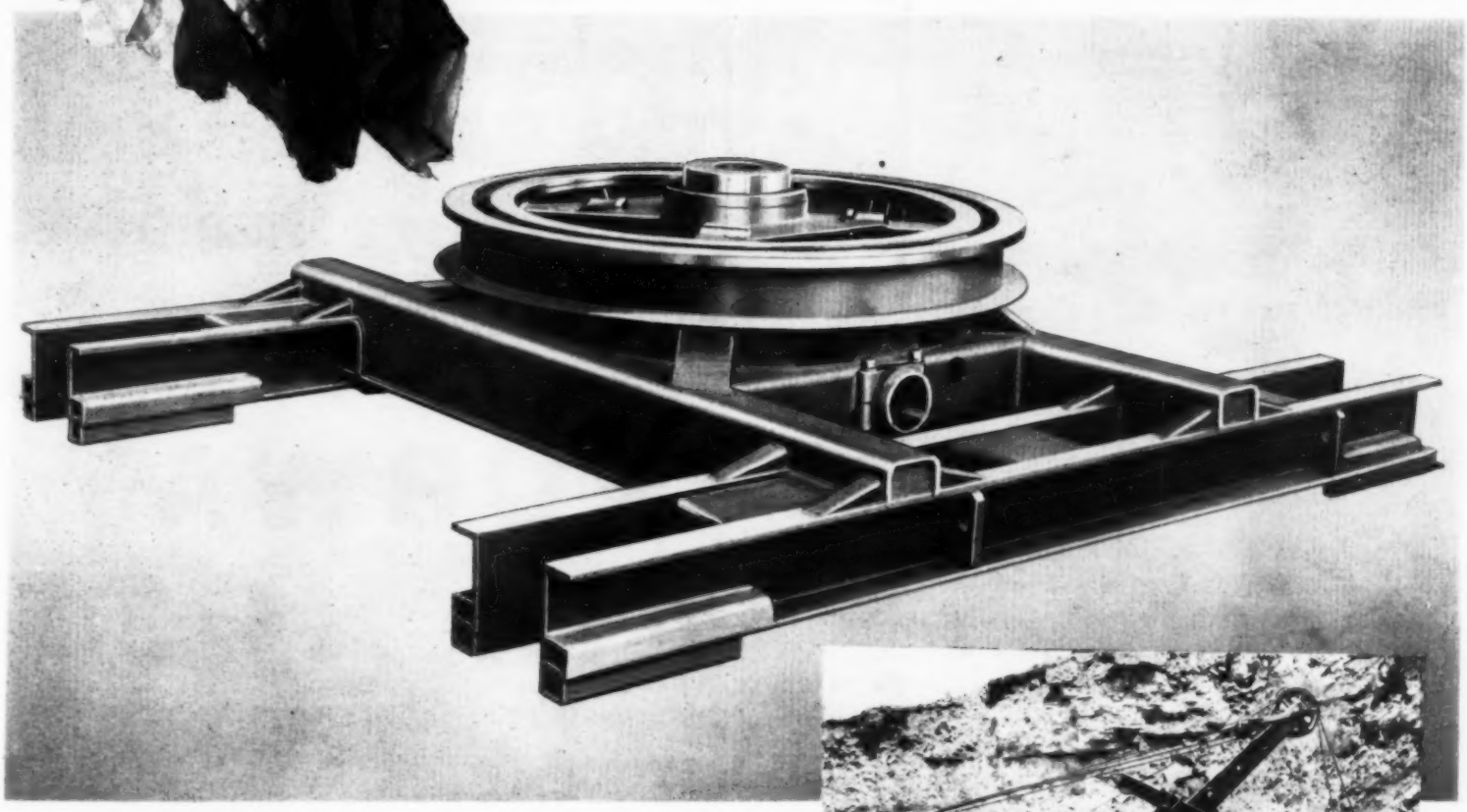
READ THESE AMAZING PERFORMANCE FACTS . . .

Total mileage covered	3,022.2 miles
Payload weight	4,590 lb.
Gross weight	9,260 lb.
Average speed	31.04 m.p.h.
Total gasoline consumed	208.73 gallons
Miles per gallon of gasoline	14.48
Oil consumed	2.92 quarts
Total cost (gas, oil, lubrication)	$43.84
Total per ton-mile cost	$.00313

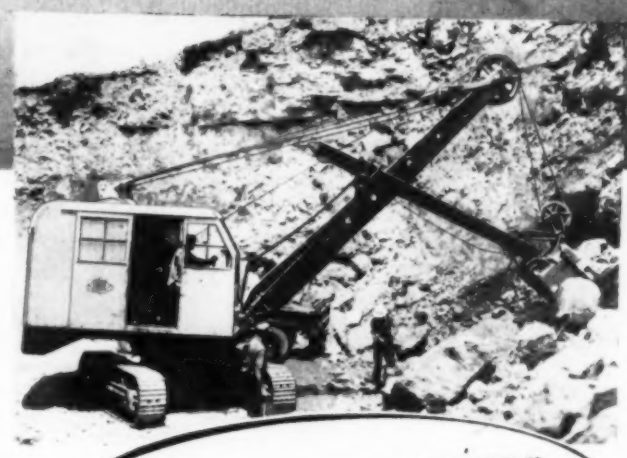
"THE THRIFT-CARRIERS FOR THE NATION"

MAKE NO MISTAKE ABOUT THIS....

BETTER EXCAVATORS ARE BUILT WITH ALLOY ROLLED STEELS



P & H Carbody and Crawler frames, unit-welded of alloy steel



● You can be mighty sure that the steel manufacturers know their steels! And they'll tell you that the new rolled alloy steels, unit-welded, are far stronger—far lighter—far better than heavier castings bolted or welded together. P & H has been first in the excavator field to recognize this fact—to build a line of machines which give you the extra advantages of speed, toughness and dependable low-cost performance which these new steels make possible. Watch others follow P & H design. Harnischfeger Corporation, 4494 W. National Avenue, Milwaukee, Wisconsin.

17 DIFFERENT MODELS
ranging from
3/8 to 5 cu. yds. capacity
7 attachment combinations.
Gasoline, Diesel or Electric Power.
Write for literature on the size and type you need.

HARNISCHFEGER
CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS **P&H** HOISTS • WELDING ELECTRODES • MOTORS

Williams' "SUPERECTOR" is powerful and fast — the ideal wrench for heavy construction work. It's built extra strong for extreme service and extra light for convenience and speed. Instantly reversible, the "SUPERECTOR" features QUADRUPLE PAWLS — *drop-forged* handle to take advantage of the super-strength afforded by the extra pawls — the characteristic speed of ratchet design — the inherent safety of the sure-gripping socket.

Expect The "SUPERECTOR" to speed up heavy jobs and reduce accident hazards. Watch it cut operating costs. Buy it with confidence — it's fully guaranteed. 5 sizes — 24 to 53" — for both Hex and Square Sockets, 1 to 4-5/8" openings.

Buy from your distributor

J. H. WILLIAMS & CO.
2 Spring Street, New York

Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable Socket Wrenches, Reversible Ratchet Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc., etc.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
"SUPERECTOR"

Tools Equipped With This *Good Red Hose* Are *Always* On the Job!

GOODALL SUBWAY AIR HOSE

With this dependable hose on your spades, hammers, breakers, drills, the job goes through without interruption — no "time out" for hose repairs or replacements. That's why you will find it the most *economical* hose for air equipment you have ever used. The next time you order, make it plain: "SUBWAY — that Red Air Hose of Goodall's." You will quickly discover why so many of your fellow contractors use those very same words!

Write for sample!

GOODALL RUBBER COMPANY
5 SOUTH 36th STREET, PHILADELPHIA, PA.

New York • Chicago • Pittsburgh • Cleveland • Houston

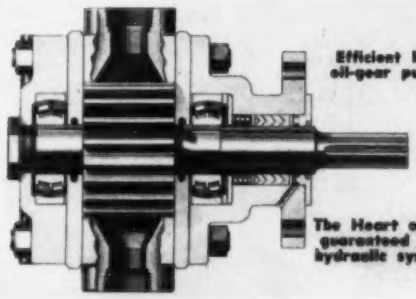
FACTORY: TRENTON, N. J.

GOODALL MECHANICAL CORP.

San Francisco • Los Angeles • Seattle

GOODALL The originators of the "Standard of Quality" Line (Reg. U. S. Pat. Off.) of contractors rubber goods

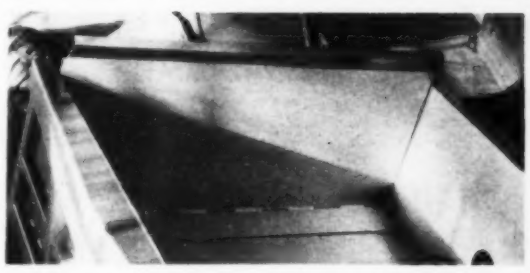
These Exclusive Heil DIG-N-CARRY Features pay off on every job



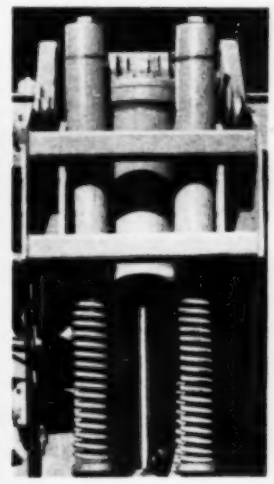
Efficient Heil oil-gear pump.

The Heart of the guaranteed Heil hydraulic system.

The Heil "Cut-Spread" indicator, mounted on top of scraper control valve, takes the guess-work out of scraper operation.



Hydraulically operated rear push-out apron and large front opening insures clean dump of wet clay and gumbo.



Booster springs give the scrape bowl buoyancy for faster loading.

Heil Dig-N-Carry Scrapers are designed, built and backed by the world famous makers of Heil hydraulic dump units — This remarkable series of hydraulic scrapers is made in 6-, 8- and 12-yard capacities — Learn more about these revolutionary, new, Heil dirt moving machines — Fill in and return the attached coupon NOW!

THE HEIL CO.

HILLSIDE, NEW JERSEY • MILWAUKEE, WISCONSIN

OK Heil. Send complete facts about Heil Dig-N-Carry Scrapers to:

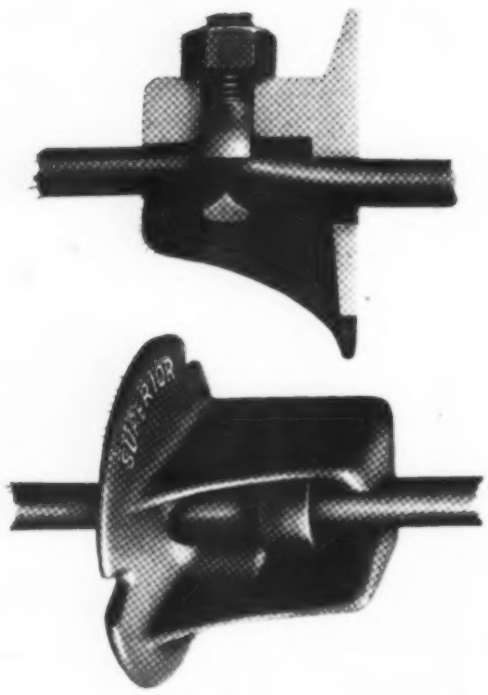
Name .....

Street ..... State .....

City .....

Superior rod clamps by RICHMOND

. . . the most economical form clamp you can use



. . . because with SUPERIOR ROD CLAMPS, you can save the clamp by replacing only the eye bolt and nut for 1/3rd the cost of the complete unit.

A sample SUPERIOR ROD CLAMP will gladly be sent on request.

RICHMOND SCREW ANCHOR CO., INC.

Tying Devices for Concrete

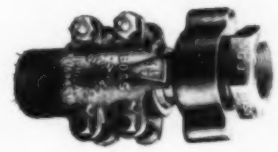
241-251 BUSH STREET
BROOKLYN, NEW YORK

BETTER PERFORMANCE LONGER SERVICE ON ANY JOB

"DIXON" AIR HAMMER COUPLINGS

Designed and built to withstand the continual vibration of hand hammers and rock drills, this Dixon coupling has a longer, consistently economical service life on the toughest job. And, like the "Boss," it is *rust*-proofed by Cadmium Plating.

"BOSS" HOSE COUPLINGS



Used for steam hose, steam hammers, air, hydraulic or road builders' hose . . . "Boss" Couplings have no equal for dependability in service. Parts are of steel or malleable iron to withstand abuse . . . Cadmium Plated for rust proofing.

Furnished in Washer or Ground Joint Type.

DIXON VALVE & COUPLING CO.

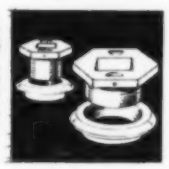
LOS ANGELES PHILADELPHIA HOUSTON

Carried in Stock by Leading Rubber Manufacturers and Jobbers.

SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

STEEL BARREL CLOSURES



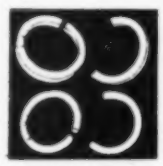
Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.

CONTAINER HANDLES

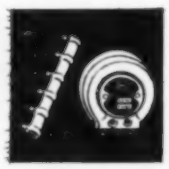
Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.



RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS



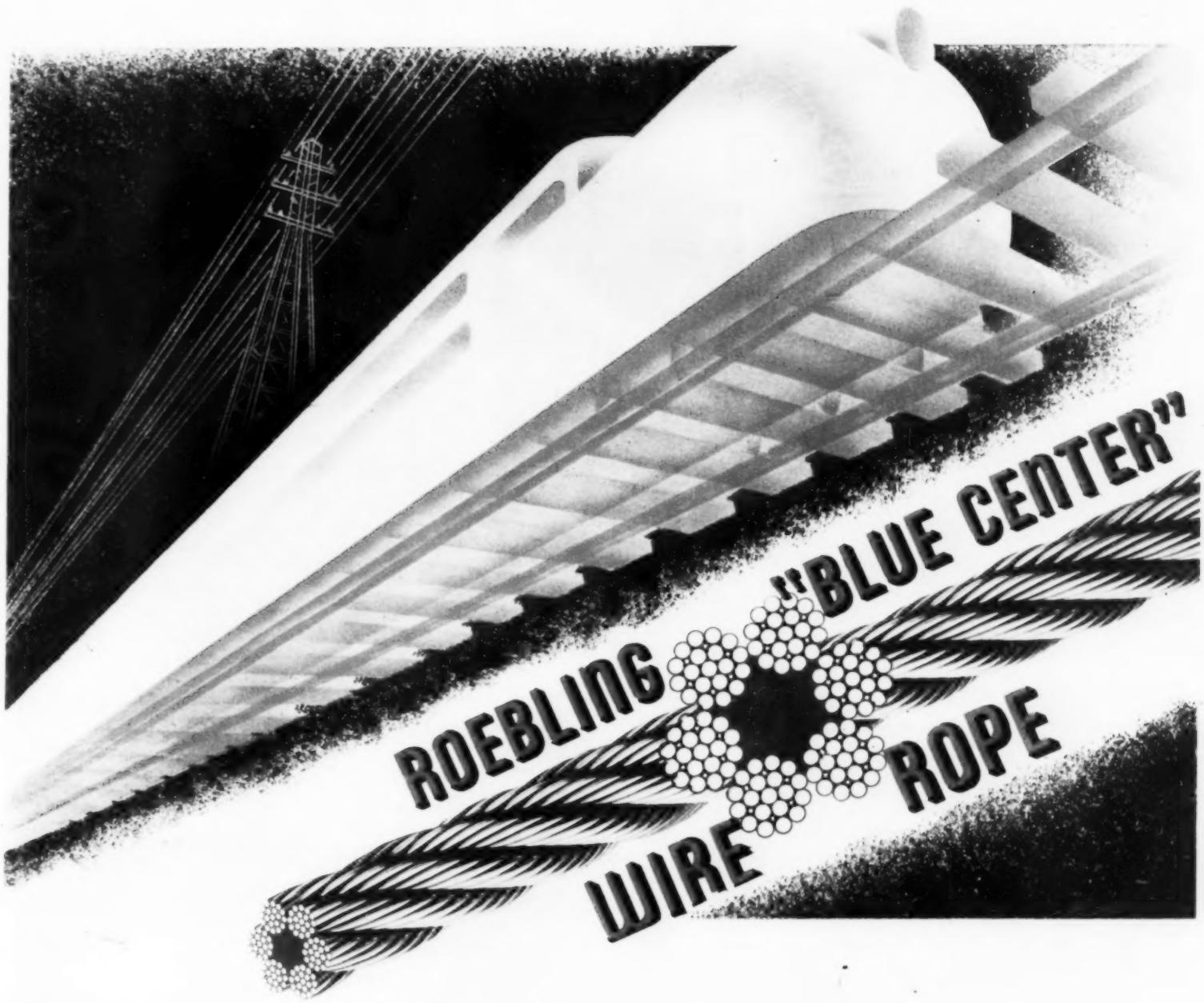
Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY

NEWARK, N.J. – EXPORT DIV., 15 E. 26 St., N.Y.C.

AS ADVANCED AS TODAY'S STREAMLINERS!



The highest achievement of the Roebling organization . . . of its unexcelled research and manufacturing facilities . . . and over ninety years of rope making experience!

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.
BRANCHES IN PRINCIPAL CITIES

STRONGER—Wire of highest strength consistent with ductility and toughness

TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

SAFER—Unequalled for uniformity of quality

SAVING—Insures lowest general average operating cost

THE HIGHEST DEVELOPMENT IN ROEBLING WIRE ROPE

THERE'S NOTHING LIKE EXPERIENCE

Die Pressed Labels Can't Come off!

From years of experience you dealers know that display is an important part of successful merchandising. And you know that shovels with the labels missing or torn will hardly make an attractive display.

This experience you passed on to us with the result that ABW developed a method of marking the brand names on shovel handles which solved the problem.

Instead of a printed label pasted on the handle, the brand name is now die pressed, in two colors, into the wood. It can't come off, become mutilated or torn.

This idea in shovels is for you to capitalize on—both in Jobber's Brands and Factory Brands. ABW shovels are as fine in appearance as they are in performance.

AMES BALDWIN WYOMING CO.
PARKERSBURG, W. VA. NORTH EASTON, MASS.
SHOVELS • SPADES • SCOOPS • FORKS • HOES • RAKES
POST HOLE DIGGERS • AGRICULTURAL HANDLES

On the Job . . . Where You Need It!

Electric Power and Light Portable DELCO-LIGHT

● Fills building needs where portable, stationary or stand-by electric service is required. Turn on Delco-Light when and where you need it. Easy to set up, move, operate. Cuts power costs—new models operate at lowest costs in history!

This Model—1500 watts—110 volts—DC . . . starts and stops automatically as load demands. 2-cylinder 3 H. P. water-cooled engine. Other models available—150 to 4000 watts—hand-operated batteryless, automatic or remote control types.

EASY PAYMENT TERMS

Available in a wide range of sizes and capacities to suit your needs. AC or DC. Ask your local Delco-Light dealer for full details on these efficient power and light plants. No obligation.

UNITED MOTORS SERVICE INC.
General Motors Building Detroit, Michigan
PRODUCT OF GENERAL MOTORS

UNITED MOTORS SERVICE INC.
General Motors Building, CM-4
Detroit, Michigan
Please send me complete information on Delco-Light Plants.

Name
Address
Town
State

Clyde QUALITY EQUIPMENT

Clyde hoists are quality hoists from every angle . . . design, workmanship and materials.
Their design is the result of years of scientific engineering combined with the requests, of critical builders and contractors, for economical and efficient machines.
Their materials are the finest obtainable and are of generous proportions to provide safety and long life to all vital parts.
Their workmanship is unexcelled . . . every hoist is carefully tested and inspected and carries a rigid guarantee against original defects.
You'll take Pride—in your Clyde!
CLYDE IRON WORKS, Inc.
Duluth, Minn.
CLYDE
CLYDE

DIESEL SHIELD-ARC

The 300-amp. Diesel-powered "Shield-Arc" Welder. Available in 200, 300 and 400 amp. ratings, stationary or portable types.

Two great forces unite to give you LOWER WELDING COSTS

Again arc welding steps ahead! Now Lincoln brings you the world's most efficient arc welder, the *"Shield-Arc,"* powered by the world's most efficient engine, the Diesel. This outstanding development introduces these advantages and economies:

LOWEST OPERATING COST—Savings in fuel cost are 33% to 86%, or as much as 40c per hour (compared to conventional gasoline engine driven welders).

15% TO 20% FASTER WELDING—It would take 6 special welders to equal the selectivity afforded by *"Shield-Arc's"* Dual Continuous Control. Gives the right TYPE and SIZE of arc to suit every one of 1001 jobs *exactly*, assuring 15% to 20% faster welding.

SIMPLIFIED DIESEL—Assures dependable, economical service. Weighs only slightly more than gasoline engine. Many parts are standard automotive type.

MODERATELY PRICED—In many cases Diesel-powered *"Shield-Arc"* Welders will pay for themselves out of fuel savings alone.

Write for free bulletin

LARGEST MANUFACTURERS OF ARC WELDING EQUIPMENT IN THE WORLD

LINCOLN

THE LINCOLN ELECTRIC CO.
Dept. G-460, Cleveland, Ohio

Send a free copy of Bulletin 327 giving details about the new Diesel powered *"Shield-Arc"* Welder.

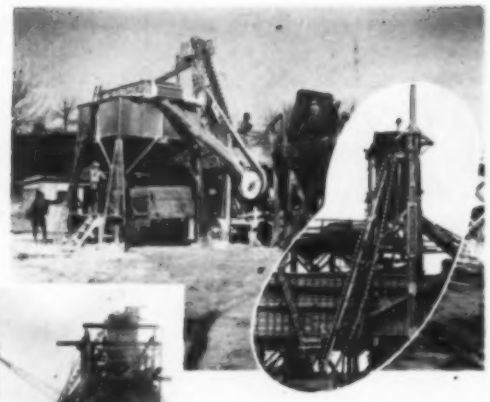
Name _____ Position _____

Company _____

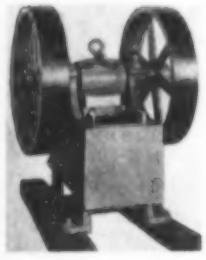
Address _____

City _____ State _____

for any Tonnage—



Universals are Best!



32 YEARS AGO

Universal put out the first overhead eccentric jaw crusher ever built in the United States. That was in 1906, and Universal engineers have always been a step ahead since then—you get design refinements on Universals today that will be copied and become standard practice in years to come. In buying crushing equipment, get the most for your money — get Universals and benefit from the experience of experts.

Whether your production demands are for carloads or truckloads of crushed rock, Universal Crushers will give you the greatest tonnages at the lowest operating cost. Over 32 years devoted exclusively to the design and manufacture of crushers and crushing plants have given Universal engineers a knowledge of operating and field conditions which has enabled them to be a step ahead with improvements.

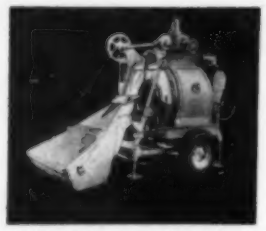
Just compare Universal's double-action pitman that delivers two crushing blows with each revolution; its simple, positive product size adjustment; the use of more and larger roller bearings; the secure mounting on the rugged base; and other detail refinements in their construction that provide for extra years of trouble-free service.

Universal Crushers are available in 22 sizes with bronze bearings and 9 sizes with roller bearings —a size and type for every crushing requirement. Investigate the new 1938 Model 1016 "Streamlined" Jaw Crusher with the lighter, stronger base! For greater profits and better crushed products, tie-up with Universal in 1938.

Send for these bulletins: Bronze Bearing Jaw Crushers, No. 100; Roller Bearing Jaw Crushers, No. 200; Roll Crushers, No. 300; 1938 Model 1016, No. 4-A.

UNIVERSAL CRUSHER COMPANY
327 8th Street West, Cedar Rapids, Iowa

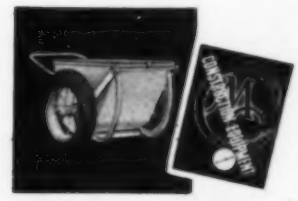
UNIVERSAL



● New CMC Streamlined Two-Wheel Trailers. Compact—fast moving — built to stand the "gaff." 5s, 7s and 10s sizes.

● CMC New Dual Prime Pumps —faster priming — greater efficiency. Sizes 1¼" up.

● CMC General Utility Double Drum Hoist. 100% hoist efficiency without extravagance in cost.



● CMC Pneumatic Tired Wheelbarrows and material carts. Save planking, cut handling costs.

WHAT'S WHAT IN MODERN EQUIPMENT!

WRITE TODAY for the new CMC equipment book. You will see the LATEST improvements in Concrete Mixers, Plaster Mixers, Pumps, Hoists, Saw Rigs, Barrows and Carts.

CONSTRUCTION MACHINERY CO.
WATERLOO, IOWA

Practical facts on every phase of building construction!

HERE is a Library of books that are packed to the covers with the best plans and methods for speeding up production, saving materials and labor, and cutting costs. These six books cover every phase of practical construction work from estimating building costs to the selling of construction service — from plan reading and quantity surveying to practical job management. With the aid of these books the contractor can get business in these dull times by learning how to make savings, and through them being able to make lower bids. The construction superintendent can learn how to keep costs down, which insures his job these days. .

The Dingman Building Contractors' Library

Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

Practical data is given on analyzing a construction job into its component parts — estimating the costs of labor, haulage, equipment, materials, etc. — plan reading and determining quantities from specifications — personnel management — successful supervision of every building operation — efficient and economical business methods — office procedure such as accounting, banking, purchasing, etc. — advertising and selling methods for contracting service — and a complete data book of tables, forms and calculations most frequently used by the builder.

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You may send me for 10 days free examination, the new six-volume Dingman BUILDING CONTRACTORS' LIBRARY. I agree either to return the books postpaid at the end of 10 days or send a first payment of $1.50 then and $2.00 a month for six months.

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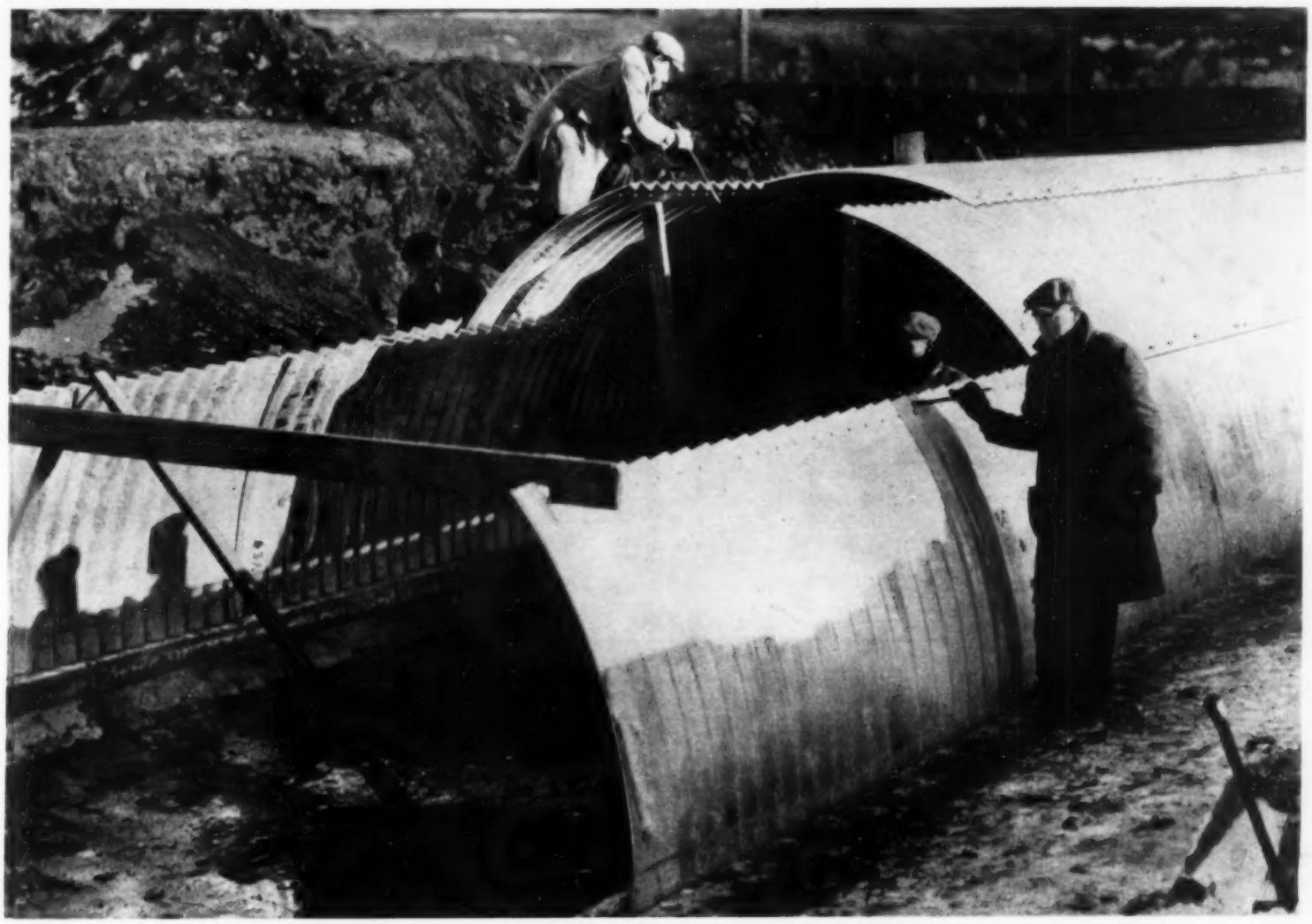
City and State ..... Company .....

(To insure prompt shipment, write plainly and fill in all lines.) CM-4-38

Costs go DOWN

. . . as these Sectional Plates go UP



U·S·S SECTIONAL PLATES are so evenly corrugated and punched that they fit together firmly and without trouble. Special skilled labor is not required for this work, and even the heavier plates can be handled and bolted by ordinary labor without the expense or bother of special tools.

Little excavation is required on most jobs. Forms are not needed, and shoring is required only for the larger spans or arches.

The ease of handling these sectional plates can mean considerable saving to you in reduced labor costs and time saved. And these plates carry their economy even beyond the finish of the construction job, because of the time-resisting qualities built into them. Their base of copper steel is given added protection against corrosion by an even coating of zinc. They are not affected by intermittent thaws and freezings and are strong and durable.

You will find that USS Sectional Plates will readily fit into your plans for small bridges, sewers, conduits, safety underpasses, the enclosing of small streams and the replacement of unsafe or damaged structures. Complete details on request.

U·S·S SECTIONAL PLATES

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*

Columbia Steel Company, San Francisco
Pacific Coast Distributors
United States Steel Products Company, New York, *Export Distributors*

Copper Steel Galvanized Sheets for smaller conventional types of roadway and drainage culverts are also made by:
Carnegie-Illinois Steel Corporation, *Pittsburgh-Chicago*
Columbia Steel Company, *San Francisco*
Tennessee Coal, Iron & Railroad Company, *Birmingham*

UNITED STATES STEEL

When You're In A Hole...

Getting you out of bad situations is a specialty of Baker Direct Lift Bulldozers, Gradebuilders, and Hydraulic Scrapers. Pushing out mired trucks, helping steam shovels to perform efficiently in pits and spreading material on the dump are just a few of the jobs Baker Bulldozers do. Likewise Baker Hydraulic Scrapers, light, powerful, clean dumping and spreading save the day when you are hard pushed on an earth moving job.

This Baker Bulldozer on an Allis-Chalmers Tractor all in a few minutes will be doing duty in the pit, pushing a mired truck, and climbing up to spread dirt on the dump. (Power plant excavation, Springfield, Illinois, John A. Felmley Co., Contractors).

Below, a busy 5-yard Baker Hydraulic Scraper keeping full loads going to the dump on a road job.

Write for special Bulletins on any Baker Product

THE BAKER MFG. CO.
568 Stanford Ave., Springfield, Ill.
— MAKERS OF —
BAKER TRACTOR EQUIPMENT
BULLDOZERS SCRAPERS
GRADEBUILDERS ROOTERS
ROAD DISCS MAINTAINERS

BAKER
HYDRAULIC
BULLDOZERS
AND SCRAPERS

"SPEED-QUALITY"

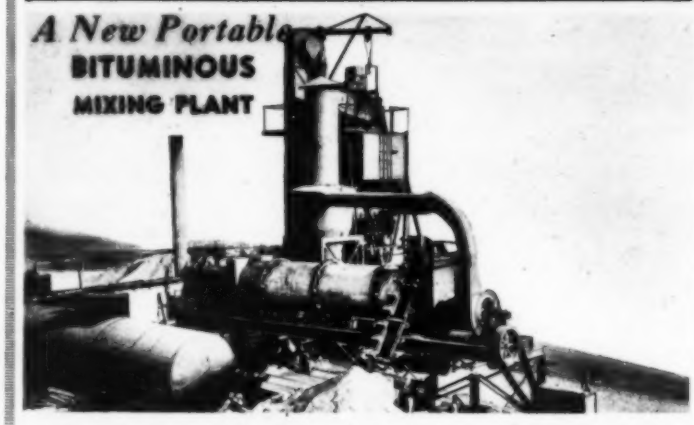
"FLEX-PLANE" Finishing Machine — forward and backward screeding — 20" wide screed — four speeds.

"Contraction Joint" — 1/8" ribbon — shrinkage is nill — it's water-tight.

Dowel Rod Spotter—gauged from the forms.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO

A New Portable
BITUMINOUS MIXING PLANT



FOR MODERN ROADWORK

. . . at Low Cost

This plant was designed to meet the demand for the economical improvement of secondary roads. We have built several to date and they have proved their worth in actual service. No investment is needed for a running gear, plant adapted to standard flat bed truck and trailer hauling.

Some Details

- Can be erected by 3 or 4 men in a few days.
- No erection equipment required. Plant equipped with hoist and jib crane.
- Built in 2 units (dryer unit; and screening and mixing unit).
- Comply with most highway loading and clearance regulations.
- SKF bearings throughout. Fully enclosed vibrating screen. Steam-jacketed, steam-operated steel mixer. Large combustion chamber and dust collector.
- Write for Bulletin T-250.

HETHERINGTON & BERNER, INC.
701-745 Kentucky Avenue Indianapolis, Ind.

...Gives your men adequate protection against dust hazards!

STATES having silicosis and dust-control laws have approved the use of flexible "Ventube" rubberized ventilating duct. Tests prove that "Ventube" reduces the dust content in the air well below the safe hygienic requirements. It carries an abundant supply of clean, fresh air to the most remote working face—sucks out or forces back the foul, dust-laden air from the operating zone.

Right now "Ventube" is helping speed the work on two of the biggest and toughest jobs—the Delaware Aqueduct and New York City's Sixth Avenue Subway.

"Ventube" reduces man-hours, as it hangs faster. Can be moved and taken down quicker. Telescopes back away from the face quickly and easily when blasting. "Ventube" eliminates unnecessary and costly delays by getting rid of dust and powder fumes immediately.

Test a few sections of "Ventube" ventilating duct on your toughest job. A single trial will show you how "Ventube" can save you time and money and make work safer. There is a distributor located nearby who will be glad to submit plans for giving you the most efficient ventilation at the lowest cost.

DU PONT
VENTUBE
REG U.S. PAT OFF

THE FLEXIBLE VENTILATING DUCT

E. I. DU PONT DE NEMOURS & CO., INC. *"Fabrikoid" Division, Fairfield, Conn.*

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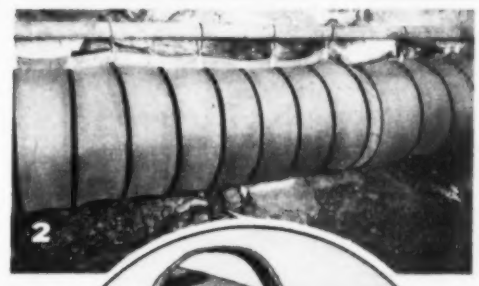


2

3

1. Regular type "Ventube" gives you efficient ventilation by bringing in fresh air to remote working faces.

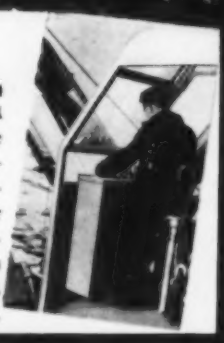
2. Non-collapsible "Ventube" can be used to expel the dust-laden air from the tunnel or to carry in good air.

3. Du Pont's powder bag is made of the same type of material as is flexible "Ventube" ventilating duct. This tough, rubberized material will give long, economical service under severest conditions. Write for sizes, prices and complete information.

These Buckeye MACHINES ARE EXACTLY WHAT YOU NEED FOR 1938 ROAD WORK PROFITS

Clipper
EXCAVATOR with METERED VACUUM CONTROL

Assures instant response through finger tip pressure, taking shovel operation out of manual labor field. Correct design. Rugged strength. For rough work or fine grading. A money maker for its owner.



Buckeye
SURFACE MATERIAL SPREADER FOR ACCURACY

Lays down exactly measured volume of material over every square yard of surface to be covered. Saves time, labor and material. Handles sand to 1 inch stone and spreads volume from a mere sprinkle to 60 pounds per square yard. Helps make those spreading jobs profitable.

HIGHWAY WIDENING MACHINE FOR SPEED

Digs trench of uniform width and depth, leaving subgrades undisturbed, true to grade, clean and ready to receive material. Digs at rate of mile or more per day.

BID THE Buckeye WAY

ask for our operation data before you bid

The BUCKEYE TRACTION DITCHER Company
FINDLAY, OHIO

THE BUCKEYE TRACTION DITCHER CO., FINDLAY, OHIO

Please send operation data and other information on the machine checked.

☐ SURFACE MATERIAL SPREADER
☐ HIGHWAY WIDENING MACHINE
☐ SEND A SALES ENGINEER

CLIPPER EXCAVATOR
☐ MODEL 50—½ YD.
☐ MODEL 60—⅝ YD.
☐ MODEL 70—¾ YD.

☐ SHOVEL
☐ TRENCH HOE
☐ CRANE
☐ CLAM SHELL
☐ DRAGLINE

DATE 1938

YOUR NAME .....

COMPANY NAME .....

CITY OR POST OFFICE ..... STATE .....

Next Time - It'll be MORETRENCH first!

The river was 18′ above subgrade, and the steel cofferdam had a penetration 6′ below that. A boiling bottom chased them out. They drove a second set of steel on the outside with a penetration 16′ below subgrade—and got chased out again. Moretrench then took command and this time the boils got chased out.

The contractor writes: "We were able to dewater the quicksand and complete our excavation without any further difficulties. Working conditions were much better, and we had a safe hole to work in. *It was unfortunate for us that we did not avail ourselves of your system at the start of the job. The work could have been accomplished in a much shorter time and the expenses incurred could have been cut to a great extent.*"

MORETRENCH · PROGRESS · QUICK FINISH

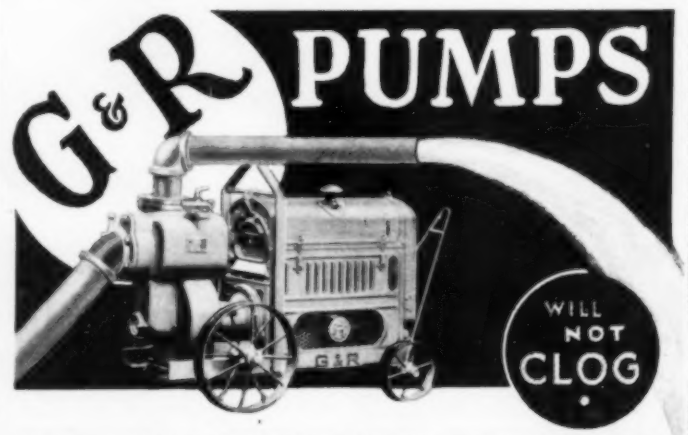
An Inseparable Trio · There Are Many Reasons

MORETRENCH CORPORATION

Sales and Rental Office:
90 West Street, New York

Plant:
Rockaway, New Jersey

G & R PUMPS



Claims **of fastest priming, highest suction lift, more gallons per minute, etc., *do not pump water*. On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.**

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water *under any condition*, than any other pump. We will ship you one and let you be the judge.

Remember this about G & R Pumps — THEY WILL NOT CLOG — THEY ASK NO TIME OUT. Play safe! Try a G & R Self-priming Centrifugal before you buy any pump this year.

Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.

The Most DEPENDABLE Pump for The Least Money

THE GORMAN-RUPP CO. Mansfield, Ohio

Complete Equipment

for Unloading Storage Batching Handling

Hundreds of successful installations of Portable Bulk Cement Plants for road construction provide the experience which Blaw-Knox will build into a plant for you.

Your plant will be designed for rapid and low cost erection, dismantling and moving. It will be low in operating costs and maintenance, and it will include the following equipment:

STEEL STORAGE BIN (portable)—Weathertight and moisture proof.

WEIGHING BATCHER—Manual or automatic operation. Equipped with no-jam, leakproof gates. Either beam type or springless dial scales.

CONVEYING EQUIPMENT for elevating cement into storage bin with necessary unloading equipment for receiving cement in hopper bottom cars, box cars or truck delivery.

POWER UNIT and drive for the conveying equipment, either gas or electric powered.

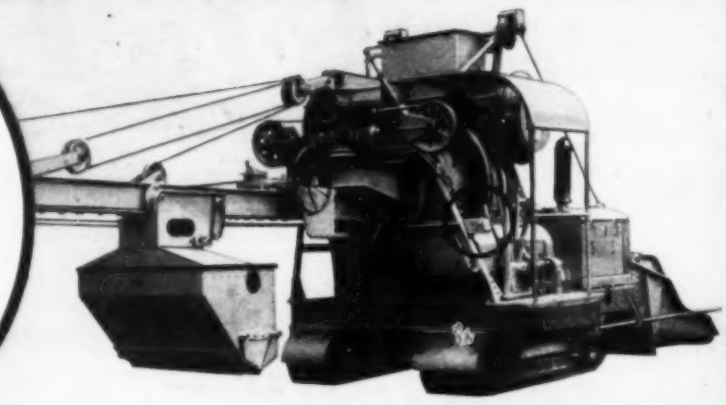
CEMENT BAGS for handling bulk cement in compartment trucks.

Blaw-Knox Bulk Cement Plants represent the ultimate in portability, speed, and convenience of use and operation. They are completely described in Blaw-Knox Catalog No. 1566, a copy of which will be sent to you upon request.

BLAW-KNOX DIVISION
of Blaw-Knox Company
2086 FARMER'S BANK BUILDING PITTSBURGH, PA.
Offices and Representatives in Principal Cities

Blaw-Knox
Bulk Cement Bag
for Batch Hauling

new A PAVER *with* HYDRAULIC CONTROL



27 E SINGLE DRUM AND 27E DUAL DRUM

The NEW Ransome 27-E Single and 27-E Dual Drum Pavers are now equipped with HYDRAULIC CONTROL and *Automatic* HYDRAULIC FEATURES for smoother action and better control by the operator. One of its biggest advantages is the elimination of over 90 moving parts and the elimination of practically all mechanical movements in automatic operation.

This new Finger-Tip Control, which is as foolproof and efficient as the hydraulic brake on the modern automobile, enables the operator to use less brawn thereby conserving his strength and use more mental efficiency to keep the paver and paving crew stepped up to peak production.

Write for complete details of this newest and efficient method of operating a paver.

RANSOME CONCRETE MACHINERY CO., Dunellen, New Jersey

There is a RANSOME Mixer for every type of job and made in a size to meet the requirement.

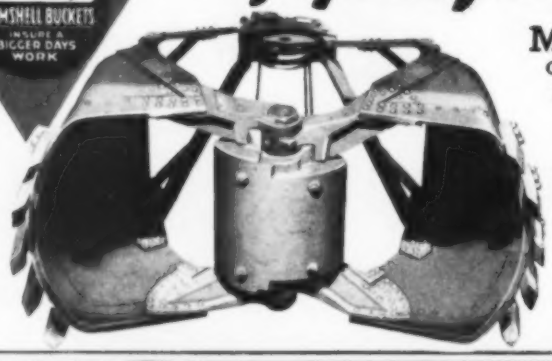
9-S Mixer | 10-S Runabout | Truck Mixers | 10-S Standard | Big Mixers

Send TODAY for your copy of the bulletin covering the product in which you are interested.

DESIGN AND CONSTRUCTION BASED ON 88 YEARS EXPERIENCE

An Owen will Open new channels of profit for YOU!

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAYS WORK



Much more versatile than you perhaps realize, an Owen Bucket will handle a greater range of work profitably than any other kind and type of bucket.

An Owen Bucket is adaptable to various digging conditions by simply changing the reeving or the amount of counterweight. It is designed for use with ingenious attachments which aid in handling difficult contracts profitably.

THE OWEN BUCKET CO.

6020 Breakwater Ave., Cleveland, Ohio
BRANCHES: New York, Philadelphia
Chicago, Berkeley, Cal.

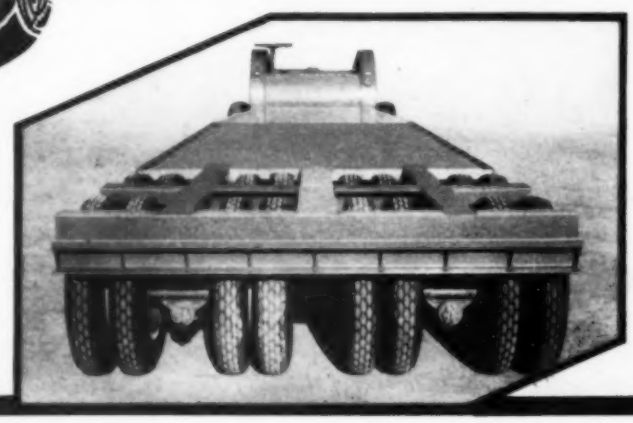
THERE IS ROGERS HEAVY DUTY Gooseneck Trailers ONE FOR EVERY PURPOSE—

• Over 25 years of specialization and wide, general acceptance has produced a complete line of standardized trailers and large volume production.

Purchase of a Rogers Trailer therefore assures getting—a unit exactly fitted to your needs—practical design developed through long experience and the utmost value for your investment.

Check these statements for yourself in the Rogers Catalog.

ROGERS BROTHERS CORPORATION
220 Orchard Street ALBION, PA.



SEMI-or FULL TRAILER

•

2 to 8 FRONT TIRES

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5 to 75 TONS CAPACITY

4 to 16 REAR TIRES

JUST PRESS THE BUTTON

FOR INSTANT AIR POWER

SCHRAMM 105 DeLuxe "Utility" Compressor. Insert showing instrument panel with gauges and starting button.

WINTER STARTING HAS ITS PROBLEMS! Think what it will mean to start your compressors as quickly, easily, safely as you do your automobile. Think of the time saved, the safety to workmen and the saving in wear on your compressor. SCHRAMM "Utility" Compressors give you built-in electric starting on every size and model. No extra cost. Just push the button — SCHRAMM "UTILITY" STARTS!

Write for SCHRAMM Bulletin 3700-CJ.
SCHRAMM INC., West Chester, Penna.

SCHRAMM

AIR COMPRESSORS

Connect all Holes with Cordeau

EASY as laying a hose . . . and no more hazardous when Cordeau-Bickford, the insensitive detonating fuse, is used. With a bar slid through the core of the Cordeau spool, the coil is easily carried across the tops of the loaded bore holes, unreeling as it goes. Then the end of each branch line is connected firmly so that the detonating wave reaches each charge.

Thousands of holes in a giant blast can be loaded and connected with greater safety and economy when Cordeau-Bickford Detonating Fuse is used. Firing can be planned to give successive relief of burden, effecting maximum work from every charge, and better fragmentation of material.

CORDEAU·BICKFORD

Detonating Fuse

CB71

THE ENSIGN-BICKFORD COMPANY • SIMSBURY • CONN.

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Methods and Equipment

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WELL POINT SYSTEMS
WILL DRY UP ANY EXCAVATION
Faster—More Economically
Write For Job Estimate and 32 page Catalog
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WELLPOINT SYSTEMS
33⅓% more efficient
The ONLY wellpoint with water inflow through entire screen circumference.
WHY?—Because no solid rods or flutes are used as separators!
Write for new catalog, "Pointed Wellpoint Facts."
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725 East 140th St., New York
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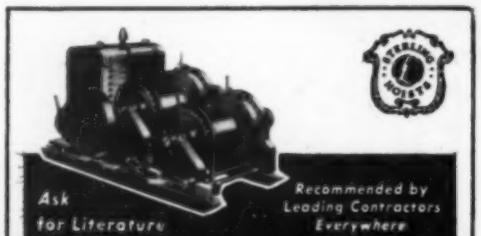
Concrete VIBRATORS and Grinders
Write for Circular on types, sizes and prices
White Mfg. Co.
ELKHART INDIANA



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STRAIGHT EDGES — Aluminum or Steel • **EDGERS** — Stamped or Cast Iron • **HAND FLOATS** — Standard or Special • **BULL FLOATS** and **HAND SCREEDS** • **CONCRETE BROOMS** of Bass or Bassine.
L. and M. MANUFACTURING COMPANY
Division of Mondie Forge Company, Inc.
10300 BEREA ROAD, CLEVELAND, OHIO

SEARCHLIGHT SECTION

ROAD MACHINERY FOR RENT

Practically New Demonstrator Models with Factory Guarantee — First 60 Days' Rent Can Be Applied toward Purchase if Desired — REAL BARGAINS, ACT QUICK!

BITUMINOUS PAVERS:
2 — 9-12 Ft. Adjustable Pavers, late model with semi-crawler wheels. Heated Screeds at small extra cost.

REBUILT FINISHING MACHINES:
1 — 9-11 Ft. Finisher
1 — 18-20 Ft. Finisher
1 — 20 Ft. Gas-Electric Finisher
1 — 20 Ft. Vibratory Finisher

MIX-IN-PLACE ROAD BUILDERS:
Combination Traveling Pug Mill and Spreader Finisher, for One-Pass Mixing and Finishing of Bituminous Retread of Stabilized Base.

1 — Model MP-1, Tractor Drawn Road Builder for light retread or stabilization, complete with screed and leveling attachment — 85 H.P. engine on pug mill.

1 — Model MP-2 Self-Propelled Road Builder for heavy mat or stabilization work. Twin pug mill, crawlers, screed and leveling device for mixing and finishing in one pass. 150 H.P. engine.

ALSO A FULL LINE OF MIXERS, PUMPS, HOISTS, TOWERS, SIDE DISCHARGE TRUCK MIXERS, SPECIAL ROAD GRADERS, CONCRETE SPREADERS, etc., for sale or rent. Write us for astonishingly low prices or rental terms.

THE JAEGER MACHINE CO.
800 W. Spring St., Columbus, Ohio

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must be received by the 10th of the month to appear in the issue out the following month.

Address copy to the Departmental Advertising Staff
CONSTRUCTION Methods and Equipment, 330 West 42d St., New York City

CONSTRUCTION Methods and Equipment

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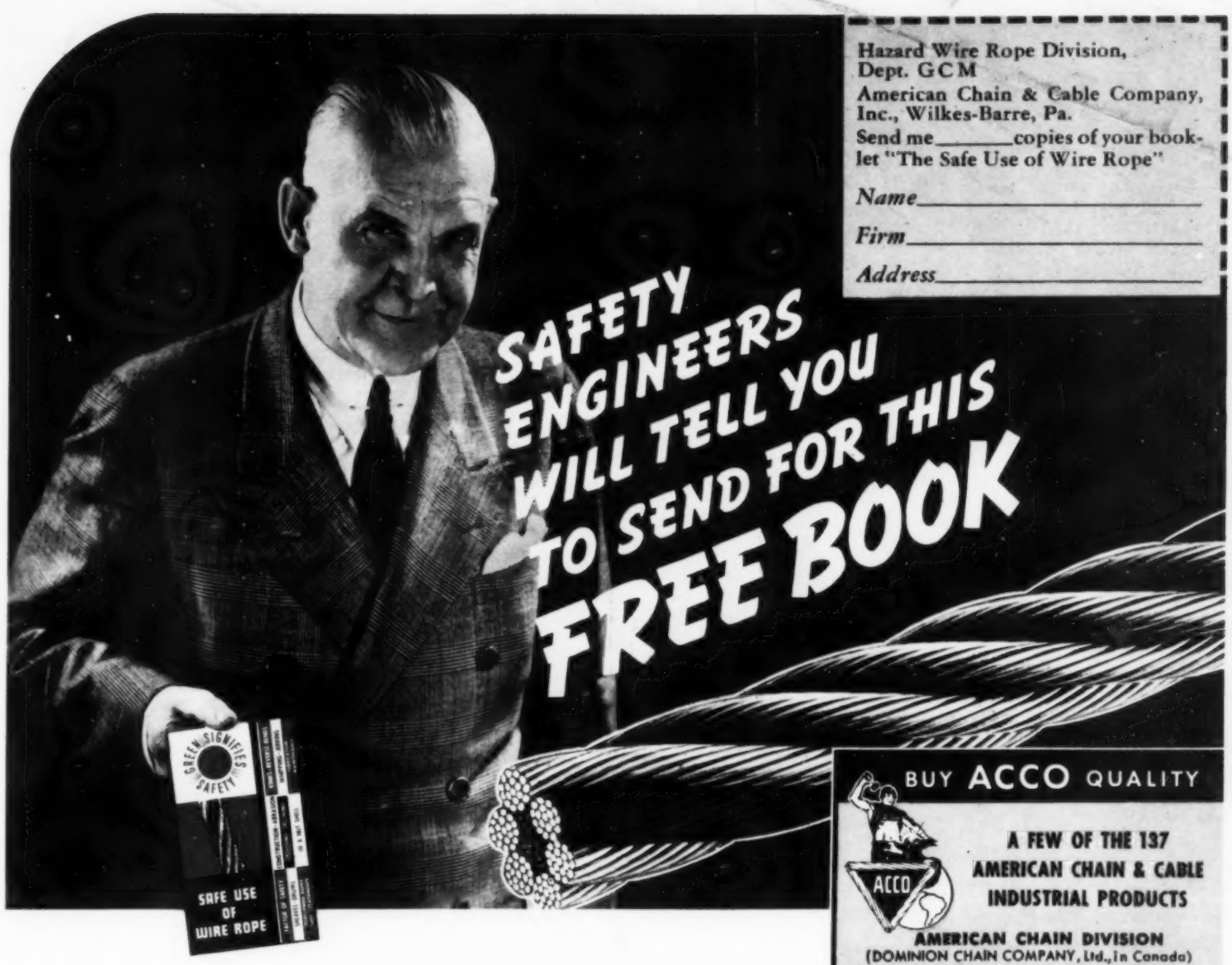

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